Add Math Past Papers

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by

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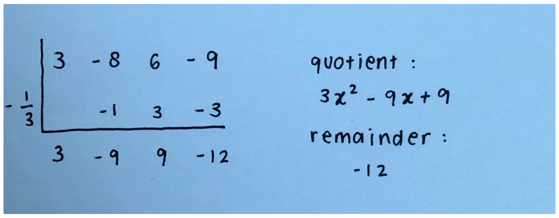
Jas 1 :

Find the quotient and remainder when $3x^3 - 8x^2 + 6x - 9$ is divided by (3x+1)

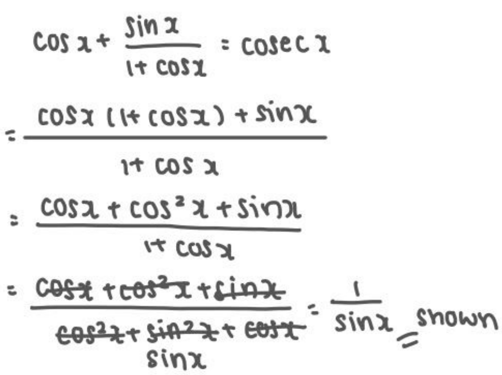
Kar 3:



Jas 2 :

Show that cot θ + $\frac{sin\theta}{1+cos\theta}$ = cosec θ

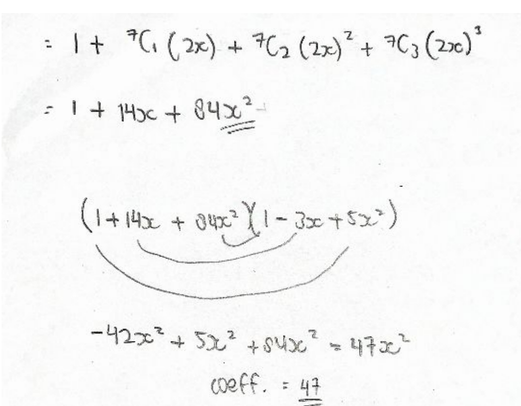
Kay 1:



Jas 3 :

Find the first three terms, in ascending powers of x, in the expansion $(1 + 2x)^7$. Hence find the coefficient of x^2 in the expansion of $(1 + 2x)^7(1 - 3x + 5x^2)$

Ela 1:

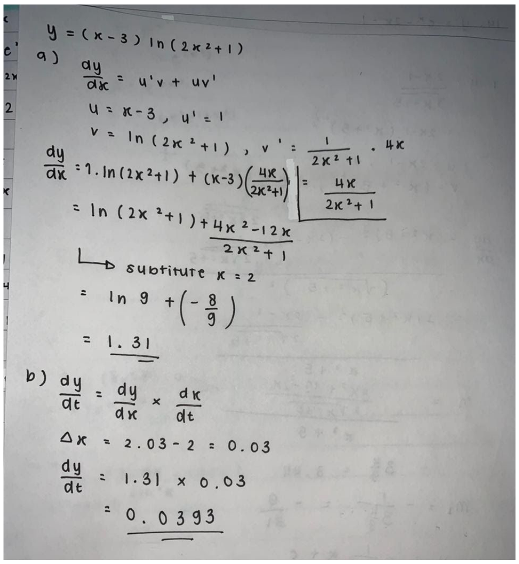


Jas 4 :

Variables x and y are such that y = (x-3) ln $(2x^2 + 1)$

a. Find the value of $\frac{dy}{dx}$ when x = 2
b. Hence find the approximate change in y when x changes from 2 to 2.03.

Gis 1:



$y = (x-3)\ln(2x^2+1)$

a) $\frac{dy}{dx} = u'v + uv'$

$u = x-3,\ u' = 1$

$v = \ln(2x^2+1),\ v' = \frac{1}{2x^2+1} \cdot 4x = \frac{4x}{2x^2+1}$

$\frac{dy}{dx} = 1 \cdot \ln(2x^2+1) + (x-3)\left(\frac{4x}{2x^2+1}\right)$

$= \ln(2x^2+1) + \frac{4x^2-12x}{2x^2+1}$

↳ subtitute x = 2

$= \ln 9 + \left(-\frac{8}{9}\right)$

$= 1.31$

b) $\frac{dy}{dt} = \frac{dy}{dx} \times \frac{dx}{dt}$

$\Delta x = 2.03 - 2 = 0.03$

$\frac{dy}{dt} = 1.31 \times 0.03$

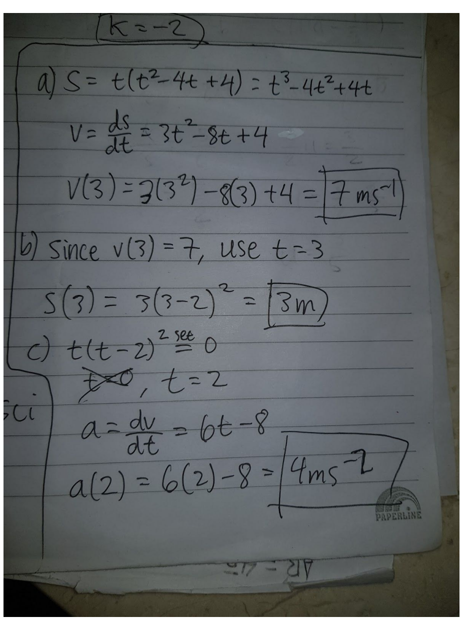
$= 0.0393$

Jas 5 :

A particle moves in a straight line so that its distance, s m, from a fixed point O on the line, is given by s = $t(t-2)^2$, where t is the time in seconds after passing O. Calculate

a. The velocity of the particle after 3 seconds,
b. The distance of the particle from O when its velocity is 7 $m\,s^{-1}$,
c. The acceleration of the particle when it is next at O .

Min 4:



(k = -2)

a) $S = t(t^2-4t+4) = t^3-4t^2+4t$

$V = \frac{ds}{dt} = 3t^2-8t+4$

$V(3) = 3(3^2)-8(3)+4 = 7\,ms^{-1}$

b) Since v(3) = 7, use t = 3

$S(3) = 3(3-2)^2 = 3m$

c) $t(t-2)^2 \overset{\text{2 see}}{=} 0$

~~t≠0~~, t = 2

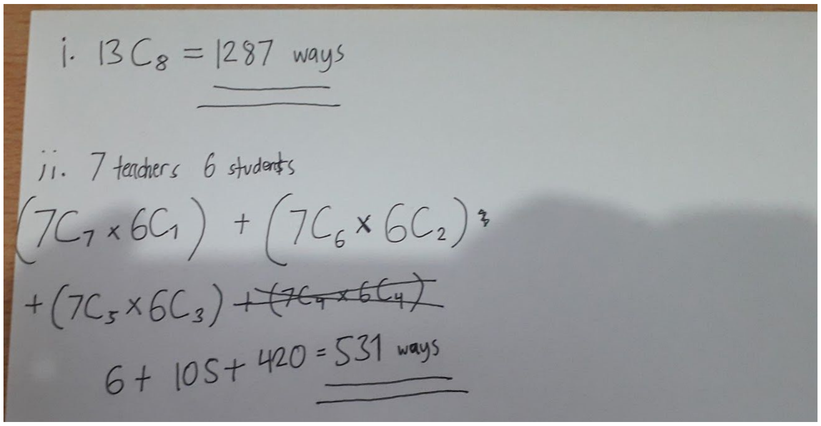
$a = \frac{dv}{dt} = 6t-8$

$a(2) = 6(2)-8 = 4ms^{-2}$

Min 1:

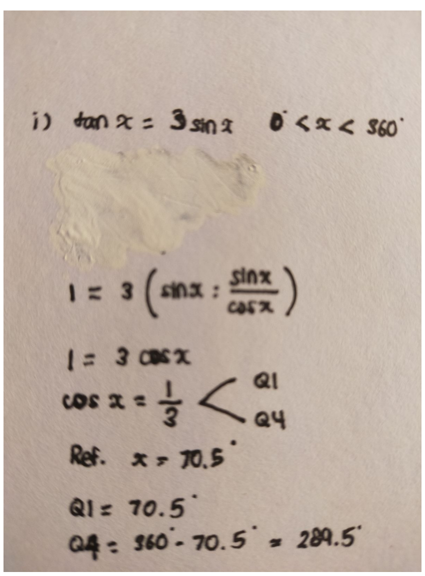
A committee of 8 people is to be selected from 7 teachers and 6 students. Find the number of different ways in which the committee can be selected if:
i) there are no restrictions,
ii) there are to be more teachers than students on the committee.

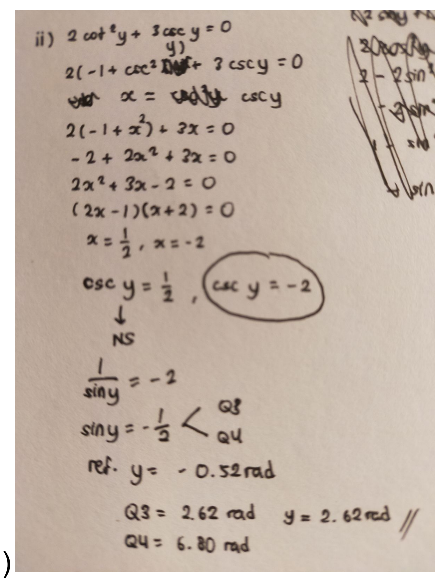
Jas 1 :



Min 2:
Solve:
i) $\tan x = 3\sin x$ for $0° < x < 360°$
ii) $2\cot^2(y) + 3\csc(y) = 0$ for $0 < x < 2\pi$

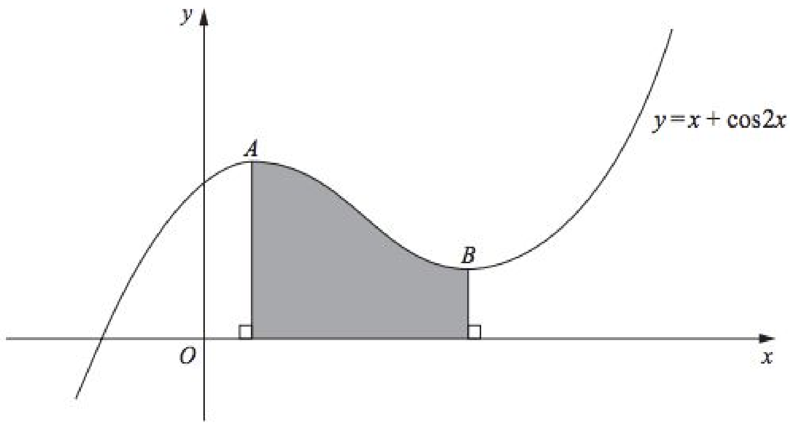
Sac 2:

i) 

ii) 

Min 3:

The diagram shows the curve $y = x + \cos(2x)$. The point A is the maximum point of the curve, and point B is the minimum point of the curve.



i) Find the x-coordinates of the points A and B,
ii) Find, in terms of π, the area of the shaded region.

Ela 2:

(i) $y = x + \cos 2x$

$1 - 2\sin 2x = 0$

$1 = 2\sin 2x$

$\sin 2x = \frac{1}{2}$

$2x = \frac{\pi}{6} \ / \ \frac{5\pi}{6}$

$x = \frac{\pi}{12}, \ \frac{5\pi}{12}$

(ii) $\int_{\frac{\pi}{12}}^{\frac{5\pi}{12}} (x + \cos 2x)$

0.25

$\left[\frac{1}{2}x^2 - \frac{1}{2}\sin 2x\right]_{\frac{\pi}{12}}^{\frac{5\pi}{12}}$

$\frac{1}{2}\left(\frac{25\pi^2}{144}\right) - \frac{1}{2}\sin 2\left(\frac{5\pi}{12}\right)$

$\frac{25\pi^2}{288} - \frac{1}{2}\sin\frac{10\pi}{12}$

$\frac{25\pi^2}{288} - \frac{1}{2}\sin\frac{10\pi}{12}$

$\frac{1}{2}\left(\frac{\pi}{12}\right)^2 - \frac{1}{2}\sin 2\left(\frac{\pi}{12}\right)$

$\frac{\pi^2}{288} - \frac{1}{2}\sin\frac{2\pi}{12}$

$\frac{25\pi^2}{288} - \frac{1}{2}\sin\frac{10\pi}{12} - \frac{\pi^2}{288} + \frac{1}{2}\sin\frac{2\pi}{12}$

$\frac{24\pi^2}{288} + \frac{1}{2}\left(\sin\frac{2\pi}{12} - \sin\frac{10\pi}{12}\right)$

$= \frac{24\pi^2}{288}$

Min 4:

A particle moves in a straight line so that, *t* seconds after passing through a fixed point O, its velocity, v m/s, is given by :

$$v = \frac{20}{(2t+4)^2}.$$

Find:

i) the velocity of the particle at O,
ii) the acceleration of the particle when t = 3,
iii) the distance travelled by the particle in the first 8 seconds.

Kar 2:

$V = \frac{20}{(2t+4)^2}$

(i) $t = 0$

↳ $V = 1.25\ m/s$

(ii) $V = 20(2t+4)^{-2}$

$a = -40(2t+4)^{-3} \cdot 2$

$= -80(2t+4)^{-3}$

$t = 3$

↳ $a = -0.08\ m/s^2$

(iii) $S = \frac{20(2t+4)^{-1}}{2 \cdot -1} + C$

$= -10(2t+4)^{-1} + C$

$S = 0 \quad t = 0$

$C = 2.5$

$S(1) = \frac{5}{6}$, $S(2) = \frac{5}{4}$, $S(3) = \frac{3}{2}$, $S(4) = \frac{5}{3}$

$S(5) = \frac{25}{14}$, $S(6) = \frac{15}{8}$, $S(7) = \frac{35}{18}$, $S(8) = 2$

total distance: $\frac{17}{6}$ m

Min 5:

Relative to an origin O, the position vectors of points A and B $\begin{pmatrix} 7 \\ 24 \end{pmatrix}$ and $\begin{pmatrix} 10 \\ 20 \end{pmatrix}$ respectively.
Find:

(i) the length of $\overrightarrow{OA}$,

(ii) the length of $\overrightarrow{AB}$.

Given that *ABC* is a straight line and that the length of $\overrightarrow{AC}$ is equal to the length of $\overrightarrow{OA}$, find

(iii) the position vector of the point *C*.

Haz 4:

4) i) $\sqrt{7^2 + 24^2} = 25$

ii) $\sqrt{3^2 + (-4)^2} = 5$

iii) $\overrightarrow{AC} = \overrightarrow{OA}$

$\overrightarrow{AC} = 25$

$\overrightarrow{AC} = 5\overrightarrow{AB} = \begin{pmatrix} 15 \\ -20 \end{pmatrix}$

$OC = OA + AC$

$= \begin{pmatrix} 7 \\ 24 \end{pmatrix} + \begin{pmatrix} 15 \\ -20 \end{pmatrix}$

$OC = \begin{pmatrix} 22 \\ 4 \end{pmatrix}$

Haz 1:

The variables x and y are such that $y = ln(3x - 1)$ for $x > \frac{1}{3}$.

i) Find $\frac{dy}{dx}$

JC 2 :

$$y = \ln(3x-1)$$

$$\text{i. } \frac{dy}{dx} = \frac{1}{3x-1} \cdot 3$$

$$= \frac{3}{3x-1}$$

ii) Hence find the approximate change in x when y increases from In(1.2) to In(1.2)+0.125.

Jas 2 :

$$\text{ii. } \frac{dy}{dx} = \frac{\Delta y}{\Delta x}$$

$$\Delta y = \ln(1.2) + 0.125 - \ln(1.2)$$

$$= 0.125$$

$$y = \ln(1.2)$$

$$e^{\ln(1.2)} = e^{(3x-1)}$$

$$\frac{6}{5} = 3x - 1 \rightarrow 3x = \frac{11}{5} \rightarrow \frac{11}{15}$$

$$\frac{dy}{dx}\left(\frac{11}{15}\right) = \frac{0.125}{\Delta x} \rightarrow \frac{3}{\frac{33}{15} - 1} \rightarrow \frac{5}{2}$$

$$\Delta x = 0.125 \times \frac{5}{2} = \frac{5}{16}$$

Haz 2:

It is given that x+4 is a factor of p(x)= $2x^3 + 3x^2 + ax - 12$. When p(x) is divided by x-1 the remainder is b.

i) show that a= -23 and find the value of the constant b.

ii) Factorise p(x) completely and hence state all the solutions of p(x)=0

Kay 2:

2. $2x^3 + 3x^2 + ax - 12 \div x+4 = 0$ ← remainder

i) $x = -4$

$2(-4)^3 + 3(-4)^2 + a(-4) - 12 = 0$

$-128 + 48 - 4a - 12 = 0$

$-4a = 12 - 48 + 128$

$-4a = 92$

$a = -23$ shown

$\div x-1$, $x = 1$

$2x^3 + 3x^2 - 23x - 12 = b$

$2(1)^3 + 3(1)^2 - 23(1) - 12 = b$

$b = 2 + 3 - 23 - 12$

$= -30$

$b = -30$

ii) $2x^3 + 3x^2 - 23x - 12$

$(x+4) \rightarrow x = -4$

-4	2	3	-23	-12
		-8	20	12
	2	-5	-3	0

→ $2x^2 - 5x - 3$

$(2x + 1)(x - 3)$

$2x = -1$ $x = 3$

$x = -\frac{1}{2}$

$(x+4)(2x+1)(x-3) = 0$ Solved!

Haz 3:

Differentiate with respect to x

Cla 1:

i) $4x \tan x$

i) $4x \tan x$

$u \rightarrow 4x$ $u' \rightarrow 4$

$v \rightarrow \tan x$ $v' \rightarrow \sec^2 x$

$\frac{dy}{dx} = 4 \tan x + 4x \sec^2 x$

ii) $\frac{e^{3x+1}}{x^2-1}$

ii) $\frac{e^{3x+1}}{x^2+1}$

$u \rightarrow e^{3x+1}$ $u' \rightarrow 3e^{3x+1}$

$v \rightarrow x^2 + 1$ $v' \rightarrow 2x$

$\frac{dy}{dx} = \frac{(x^2+1)(3e^{3x+1}) - 2x(e^{3x+1})}{(x^2+1)^2} = \frac{3x^2e^{3x+1} + 3e^{3x+1} - 2xe^{3x+1}}{x^4 + 2x^2 + 1}$

Haz 4:

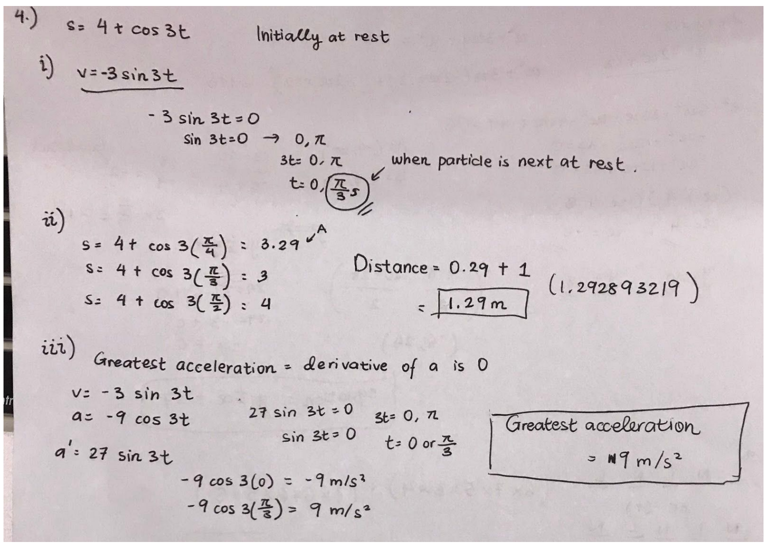
A particle moves in a straight line such that its displacement, s metres, from a fixed point O at time t seconds, is given by s=4+ cos 3t, where $t \geq 0$. The particle is initially at rest.

i) Find the exact value of t when the particle is next at rest.

ii) Find the distance travelled by the particle between $t = \frac{\pi}{4}$ at $t = \frac{\pi}{2}$ seconds.

iii) Find the greatest acceleration of the particle.

Nat 4:


4.) $s = 4 + \cos 3t$ Initially at rest

i) $v = -3\sin 3t$

$-3\sin 3t = 0$

$\sin 3t = 0 \rightarrow 0, \pi$

$3t = 0, \pi$

$t = 0, \frac{\pi}{3}s$ when particle is next at rest.

ii)

$s = 4 + \cos 3(\frac{\pi}{4}) = 3.29$ A

$s = 4 + \cos 3(\frac{\pi}{3}) = 3$

$s = 4 + \cos 3(\frac{\pi}{2}) = 4$

Distance = 0.29 + 1

= 1.29m (1.292893219)

iii) Greatest acceleration = derivative of a is 0

$v = -3\sin 3t$

$a = -9\cos 3t$

$a' = 27\sin 3t$

$27\sin 3t = 0$

$\sin 3t = 0$

$3t = 0, \pi$

$t = 0$ or $\frac{\pi}{3}$

$-9\cos 3(0) = -9 m/s^2$

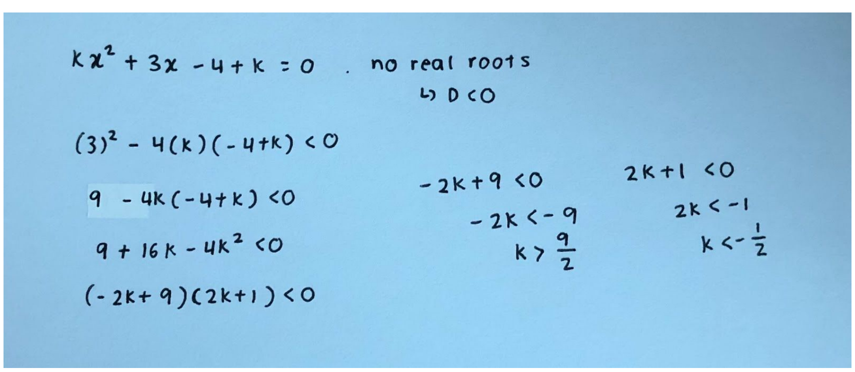
$-9\cos 3(\frac{\pi}{3}) = 9 m/s^2$

Greatest acceleration $= 9 m/s^2$

Haz 5:

Find the set of values of k for which the equation $kx^2 + 3x - 4 + k = 0$ has no real roots.

Kar 1:


$kx^2 + 3x - 4 + k = 0$. no real roots

$\hookrightarrow D < 0$

$(3)^2 - 4(k)(-4+k) < 0$

$9 - 4k(-4+k) < 0$

$9 + 16k - 4k^2 < 0$

$(-2k+9)(2k+1) < 0$

$-2k + 9 < 0$

$-2k < -9$

$k > \frac{9}{2}$

$2k + 1 < 0$

$2k < -1$

$k < -\frac{1}{2}$

Kar 1: The polynomial $p(x) = (2x-1)(x+k) - 12$, where k is a constant.

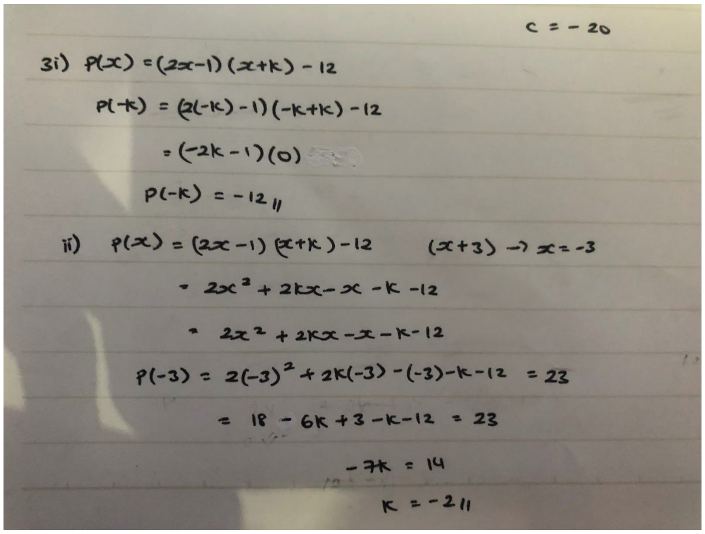
(i) Write down the value of p(-k)

When p(x) is divided by x+3 the remainder is 23.

(ii) Find the value of k.

(iii) Using your value of k, show that the equation $p(x) = -25$ has no real solutions.

Haz 3:



c = - 20

3i) $p(x) = (2x-1)(x+k) - 12$

$p(-k) = (2(-k)-1)(-k+k) - 12$

$= (-2k-1)(0)$

$p(-k) = -12$ //

ii) $p(x) = (2x-1)(x+k) - 12$ $(x+3) \to x = -3$

$= 2x^2 + 2kx - x - k - 12$

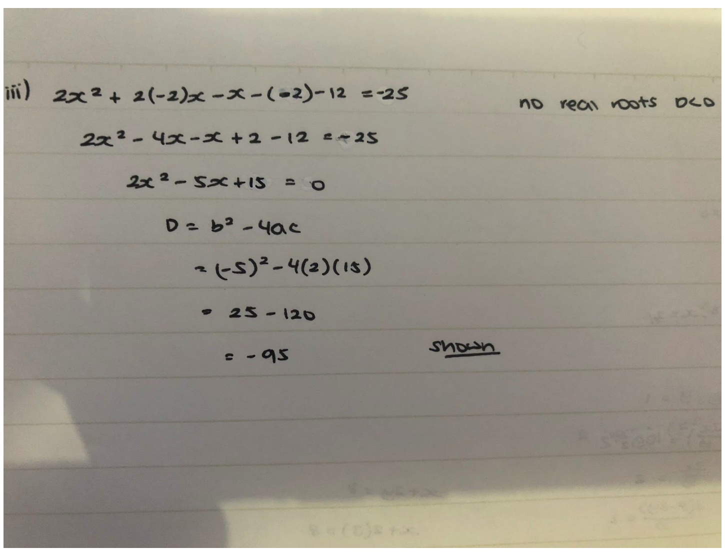
$= 2x^2 + 2kx - x - k - 12$

$p(-3) = 2(-3)^2 + 2k(-3) - (-3) - k - 12 = 23$

$= 18 - 6k + 3 - k - 12 = 23$

$-7k = 14$

$k = -2$ //



iii) $2x^2 + 2(-2)x - x - (-2) - 12 = -25$ no real roots D<0

$2x^2 - 4x - x + 2 - 12 = -25$

$2x^2 - 5x + 15 = 0$

$D = b^2 - 4ac$

$= (-5)^2 - 4(2)(15)$

$= 25 - 120$

$= -95$ shown

Kar 2:

A particle P is moving with the velocity of $20\ ms^{-1}$ in the same direction as $\begin{pmatrix} 3 \\ 4 \end{pmatrix}$.

(i) Find the velocity vector of P.

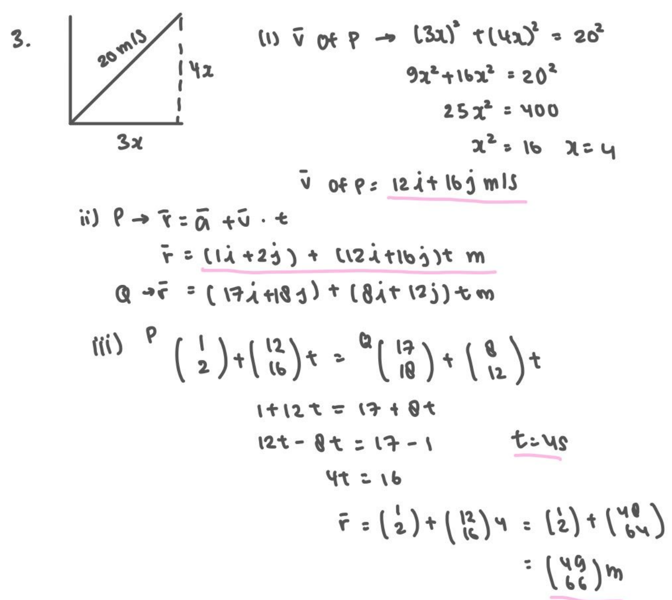
At time $t = 0\ s$, P has position vector $\begin{pmatrix} 1 \\ 2 \end{pmatrix}$ relative to fixed point O.

(ii) Write down the position vector of P after t seconds.

A particle Q has position vector $\begin{pmatrix}17\\18\end{pmatrix}$ relative to O at time $t = 0\ s$ and has a velocity vector $\begin{pmatrix}8\\12\end{pmatrix} ms^{-1}$.

(iii) Given that P and Q collide, find the value of t when they collide and the position vector of the point of collision.

Kay 3:



Kar 3:

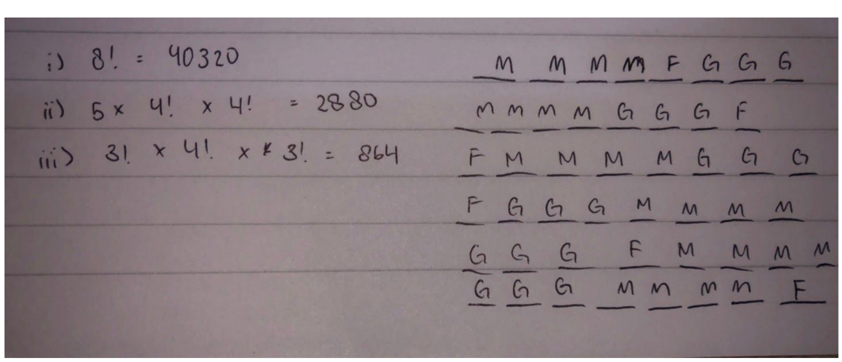
Eight books are to be arranged on a shelf. There are 4 mathematics books, 3 geography books and 1 French book.

(i) Find the number of different arrangements of the books if there are no restrictions.

(ii) Find the number of different arrangements if the mathematics books have to be kept together.

(iii) Find the number of different arrangements if the mathematics books have to be kept together and the geography books have to be kept together.

Kel 3:



Kar 4:

When e^y is plotted against $\frac{1}{x}$, a straight line graph passing through the points $(2, 20)$ and $(4, 8)$ is obtained.

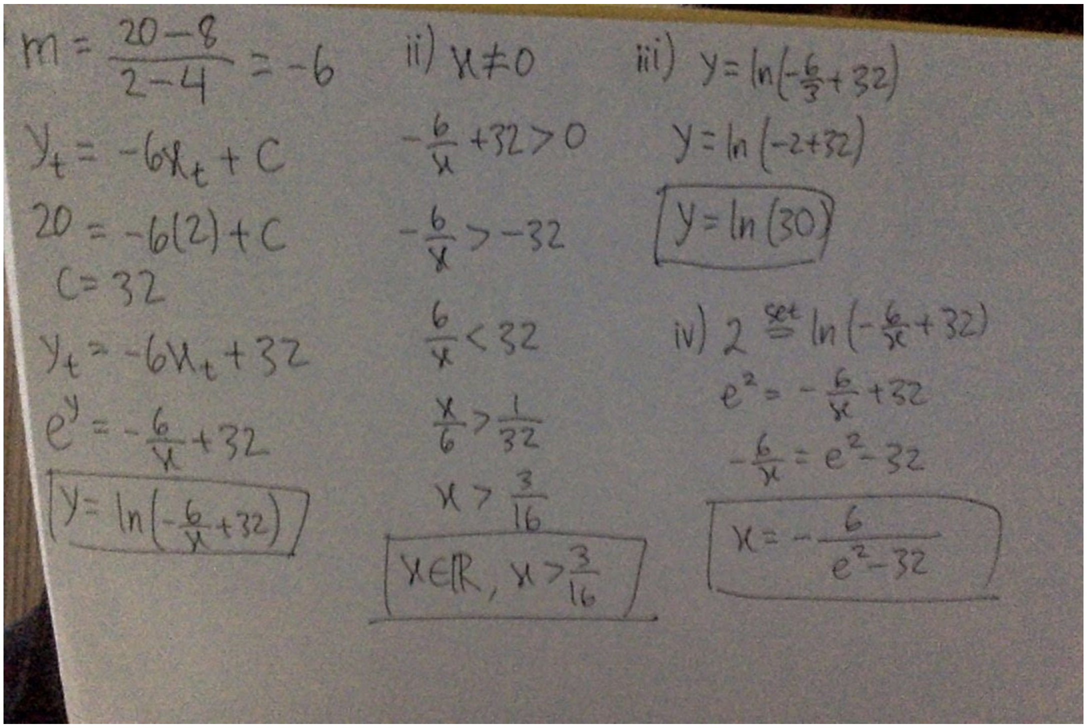
(i) Find y in terms of x.

(ii) Hence find the positive values of x for which y is defined.

(iii) Find the exact value of y when $x = 3$.

(iv) Find the exact value of x when $y = 2$.

Min :



$m = \frac{20-8}{2-4} = -6$

$Y_t = -6X_t + C$

$20 = -6(2) + C$

$C = 32$

$Y_t = -6X_t + 32$

$e^y = -\frac{6}{x} + 32$

$y = \ln\left(-\frac{6}{x} + 32\right)$

ii) $x \neq 0$

$-\frac{6}{x} + 32 > 0$

$-\frac{6}{x} > -32$

$\frac{6}{x} < 32$

$\frac{x}{6} > \frac{1}{32}$

$x > \frac{3}{16}$

$x \in \mathbb{R},\ x > \frac{3}{16}$

iii) $y = \ln\left(-\frac{6}{3} + 32\right)$

$y = \ln(-2 + 32)$

$y = \ln(30)$

iv) $2 \overset{set}{=} \ln\left(-\frac{6}{x} + 32\right)$

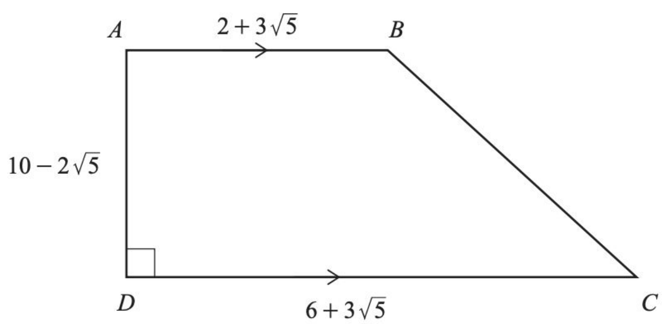
$e^2 = -\frac{6}{x} + 32$

$-\frac{6}{x} = e^2 - 32$

$x = -\frac{6}{e^2 - 32}$

Kar 5:

Do not use a calculator in this question. All lengths in this questions are in centimetres.

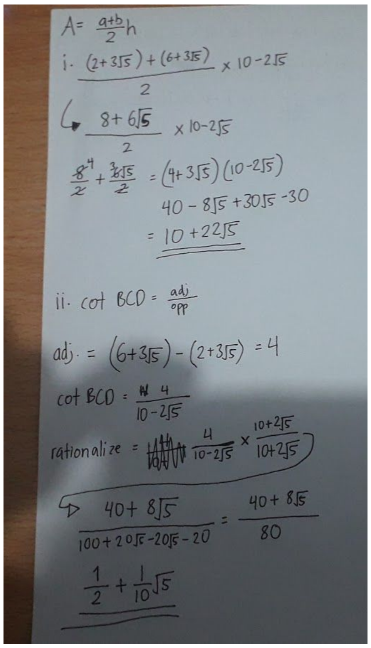


The diagram shows the trapezium ABCD, where $AB = 2 + 3\sqrt{5}$, $DC = 6 + 3\sqrt{5}$, $AD = 10 - 2\sqrt{5}$ and angle $ADC = 90^\circ$.

(i) Find the area of ABCD, giving your answer in the form $a + b\sqrt{5}$, where a and b are integers.

(ii) Find $cotBCD$, giving your answer in the form $c + d\sqrt{5}$, where c and d are fractions in their simplest form.

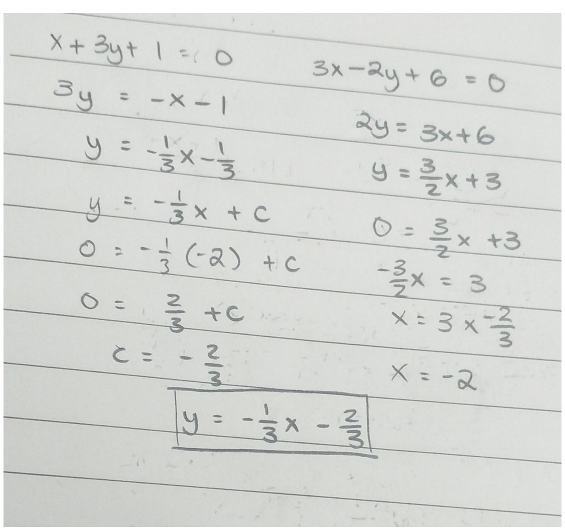
Jas 2 :



Ela 1:

Find the equation of the line parallel to $x + 3y + 1 = 0$ and passing through the point where $3x - 2y + 6 = 0$ cuts the x-axis.

Cla 2:



Ela 2:

Find all the angles between $0°$ and 360° which satisfy the equation

(i) $5\cos x + 2\sin x = 0$ (ii) $3(\sin x - \cos x) = \cos x$

Kay 5:

5. $5\cos x + 2\sin x = 0$

$2\sin x = -5\cos x$

$\frac{2}{-5} = \frac{\sin x}{\cos x}$

$\tan x = -\frac{2}{5}$ < Q_2, Q_4

$\tan^{-1}\left(\frac{2}{5}\right) = 21.80140949°$

$Q_2 = 180 - 21.8 = 158.2°$ / 2.76 rad

$Q_4 = 360 - 21.8 = 338.2°$ / 5.92 rad

$3(\sin x - \cos x) = \cos x$

$3\sin x - 3\cos x = \cos x$

$3\sin x = \cos x + 3\cos x$

$3\sin x = 4\cos x$

$\frac{\sin x}{\cos x} = \frac{4}{3}$

$\tan x = \frac{4}{3}$ < Q_1, Q_3

$\tan^{-1}\left(\frac{4}{3}\right) = 0.93$ rad / $53.1°$

$Q_3 = \pi + x = 4.07$ rad

or

$233.1°$

Ela 3:

a). A sector of a circle has an arc length of 20 cm. If the radius of the circle is 12 cm, find the area of the sector.

b). Find the value of $\tan 2x$ if x = 1.6 radians

Kar 4:

a.) $\theta r = \ell$ $A = \frac{1}{2}r^2\theta$

$\ell = 20$ cm $r = 12$cm

$\theta = \frac{20}{12} = \frac{5}{3}$

$A = \frac{1}{2} \times 12^2 \times \frac{5}{3}$

$= 120$

b.) $\tan 2x$

$x = 1.6$

$2x = 3.2$

$\tan 3.2 = 0.0585$

Ela 4:

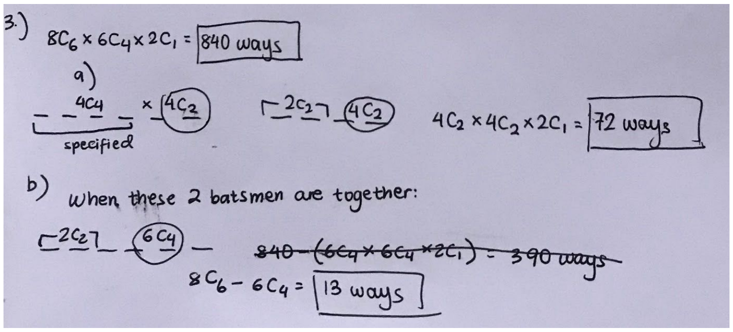
Find the number of which a team of 6 batsman, 4 bowlers and a wicket-keeper may be selected from a squad of 8 batsmen, 6 bowlers and 2 wicket-keepers.

Find the number of ways in which

(a) This team may be selected if it is to include 4 specified batsmen and 2 specified bowlers

(b) The 6 batsmen may be selected from the 8 available, given that 2 particular batsmen cannot be selected together.

Nat 3:



3.) $8C_6 \times 6C_4 \times 2C_1 =$ 840 ways

a) $\underbrace{\_\ \_\ \overset{4C_4}{\_}\ \_}_{\text{specified}} \times (4C_2)$ $\ulcorner 2C_2 \urcorner$ $(4C_2)$ $4C_2 \times 4C_2 \times 2C_1 =$ 72 ways

b) When these 2 batsmen are together:

$\ulcorner 2C_2 \urcorner$ $(6C_4)$ — ~~840 − (6C4 × 6C4 × 2C1) = 390 ways~~

$8C_6 - 6C_4 =$ 13 ways

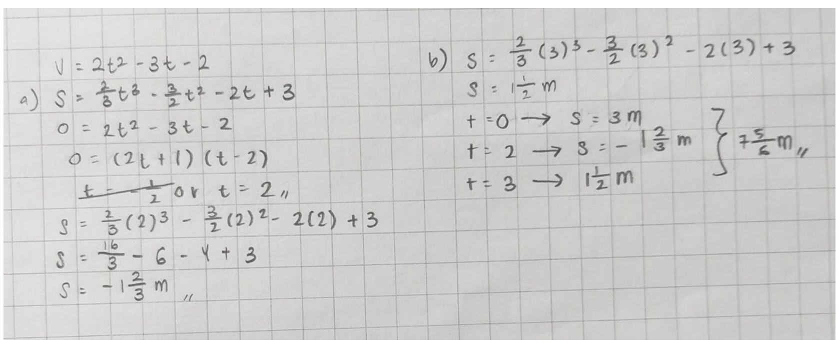
Ela 5:

A particles moves in a straight line with a velocity v m/s given by $v = 2t^2 - 3t - 2$. When $t = 0$ its displacement from the origin O is 3 m, find

(a) The value of t when the particle is at rest and the displacement at this instant,

(b) The displacement when $t = 3$ and the total distance travelled in the first 3 seconds.

Bri 4:



$V = 2t^2 - 3t - 2$

a) $S = \frac{2}{3}t^3 - \frac{3}{2}t^2 - 2t + 3$

$0 = 2t^2 - 3t - 2$

$0 = (2t + 1)(t - 2)$

~~$t = -\frac{1}{2}$~~ or $t = 2$

$S = \frac{2}{3}(2)^3 - \frac{3}{2}(2)^2 - 2(2) + 3$

$S = \frac{16}{3} - 6 - 4 + 3$

$S = -1\frac{2}{3}$ m

b) $S = \frac{2}{3}(3)^3 - \frac{3}{2}(3)^2 - 2(3) + 3$

$S = 1\frac{1}{2}$ m

$t = 0 \rightarrow S = 3$ m

$t = 2 \rightarrow S = -1\frac{2}{3}$ m

$t = 3 \rightarrow 1\frac{1}{2}$ m

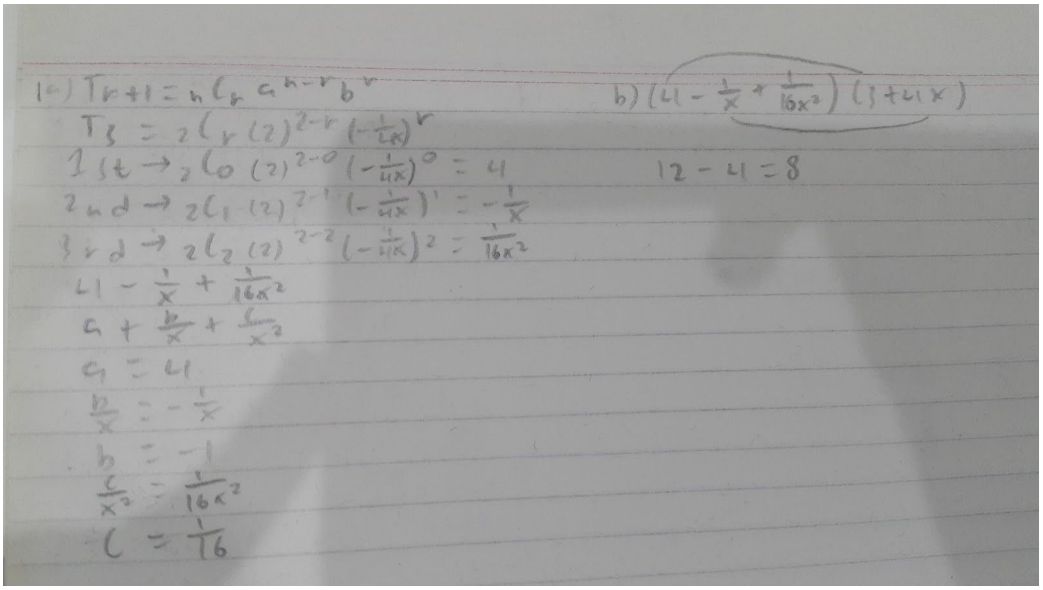
$\} \ 7\frac{5}{6}$ m

Sep 1:

a. The first 3 terms in the expansion of $(2 - \frac{1}{4x})^2$ are $a + \frac{b}{x} + \frac{c}{x^2}$. Find the value of each of the integers a, b and c.

b. Hence find the term independent of x in the expansion of $(2 - \frac{1}{4x})^2 (3 + 4x)$.

Ama 2:


1a) $T_{r+1} = {}^nC_r\, a^{n-r} b^r$

$T_3 = {}^2C_r (2)^{2-r} (-\frac{1}{2x})^r$

1st → ${}^2C_0 (2)^{2-0} (-\frac{1}{4x})^0 = 4$

2nd → ${}^2C_1 (2)^{2-1} (-\frac{1}{4x})^1 = -\frac{1}{x}$

3rd → ${}^2C_2 (2)^{2-2} (-\frac{1}{4x})^2 = \frac{1}{16x^2}$

$4 - \frac{1}{x} + \frac{1}{16x^2}$

$a + \frac{b}{x} + \frac{c}{x^2}$

$a = 4$

$\frac{b}{x} = -\frac{1}{x}$

$b = -1$

$\frac{c}{x^2} = \frac{1}{16x^2}$

$c = \frac{1}{16}$

b) $(4 - \frac{1}{x} + \frac{1}{16x^2})(3 + 4x)$

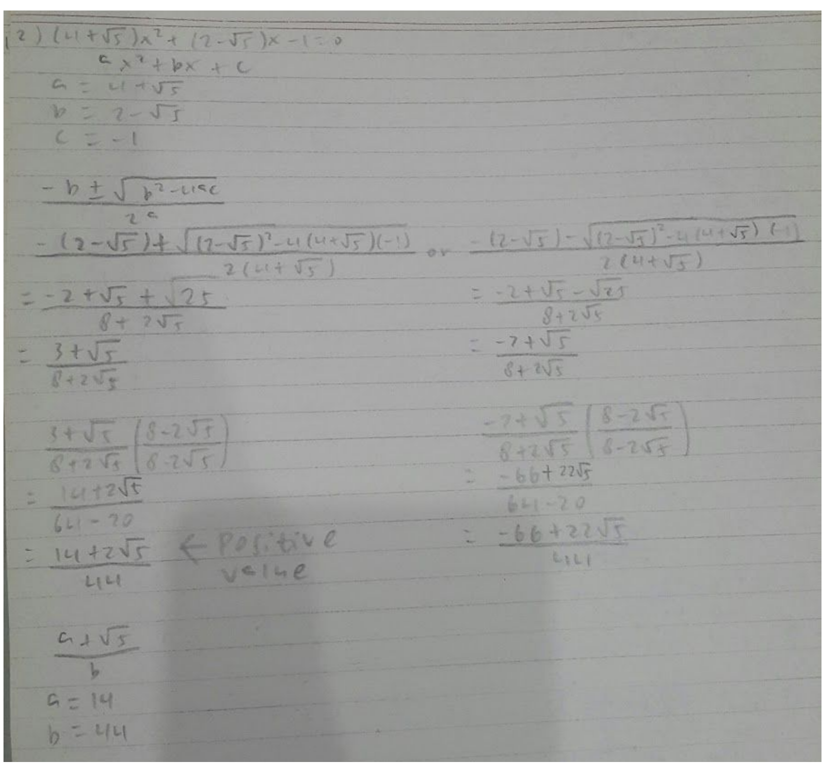
$12 - 4 = 8$

Sep 2:

(without calculator)

Find the positive value of x for which $(4+\sqrt{5})x^2 + (2-\sqrt{5})x - 1 = 0$, giving your answer in the form $\frac{a+\sqrt{5}}{b}$, which a and b are integers.

Ama 3:


2) $(4+\sqrt{5})x^2 + (2-\sqrt{5})x - 1 = 0$

$ax^2 + bx + c$

$a = 4+\sqrt{5}$

$b = 2-\sqrt{5}$

$c = -1$

$\frac{-b \pm \sqrt{b^2-4ac}}{2a}$

$\frac{-(2-\sqrt{5}) + \sqrt{(2-\sqrt{5})^2 - 4(4+\sqrt{5})(-1)}}{2(4+\sqrt{5})}$ or $\frac{-(2-\sqrt{5}) - \sqrt{(2-\sqrt{5})^2 - 4(4+\sqrt{5})(-1)}}{2(4+\sqrt{5})}$

$= \frac{-2+\sqrt{5}+\sqrt{25}}{8+2\sqrt{5}}$; $= \frac{-2+\sqrt{5}-\sqrt{25}}{8+2\sqrt{5}}$

$= \frac{3+\sqrt{5}}{8+2\sqrt{5}}$; $= \frac{-7+\sqrt{5}}{8+2\sqrt{5}}$

$\frac{3+\sqrt{5}}{8+2\sqrt{5}}\left(\frac{8-2\sqrt{5}}{8-2\sqrt{5}}\right)$; $\frac{-7+\sqrt{5}}{8+2\sqrt{5}}\left(\frac{8-2\sqrt{5}}{8-2\sqrt{5}}\right)$

$= \frac{14+2\sqrt{5}}{64-20}$; $= \frac{-66+22\sqrt{5}}{64-20}$

$= \frac{14+2\sqrt{5}}{44}$ ← Positive value ; $= \frac{-66+22\sqrt{5}}{44}$

$\frac{a+\sqrt{5}}{b}$

$a = 14$

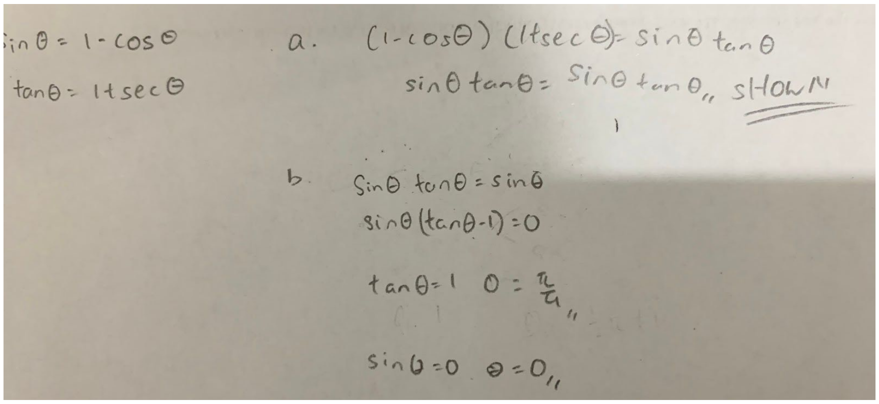
$b = 44$

Sep 3:

a. Show that $(1 - cos\theta)(1 + sec\theta) = sin\theta tan\theta$

b. Hence solve the equation $(1 - cos\theta)(1 + sec\theta) = sin\theta$ for $0 \leq \theta \leq \pi$ radians

Rai 4:


sinθ = 1 - cosθ
tanθ = 1+secθ
a. (1-cosθ) (1+secθ) = sinθ tanθ
sinθ tanθ = sinθ tanθ,, SHOWN
b. sinθ tanθ = sinθ
sinθ (tanθ-1) = 0
tanθ = 1 θ = π/4 ,,
sinθ = 0 θ = 0,,

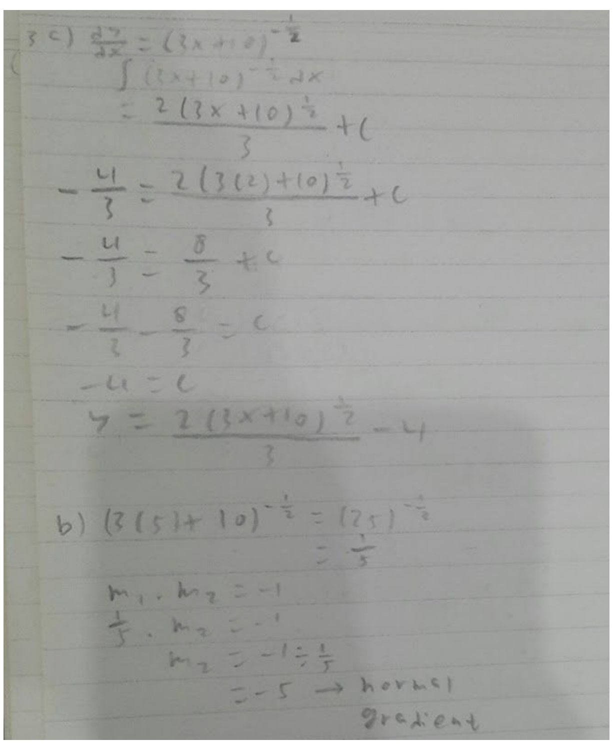
Sep 4:

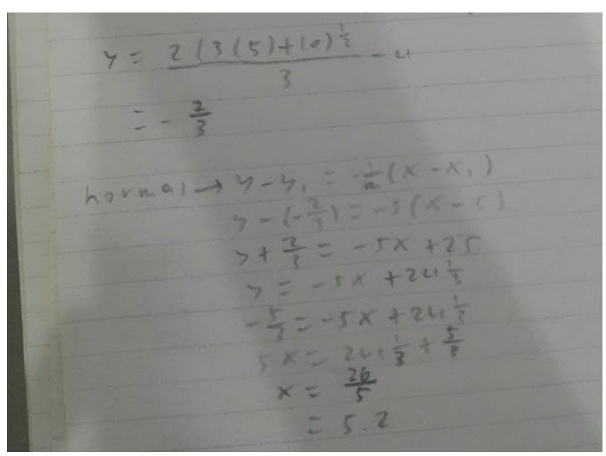
A curve passes through the point $(2, -\frac{4}{3})$ and is such that $\frac{dy}{dx} = (3x + 10)^{-\frac{1}{2}}$.

a. Find the equation of the curve

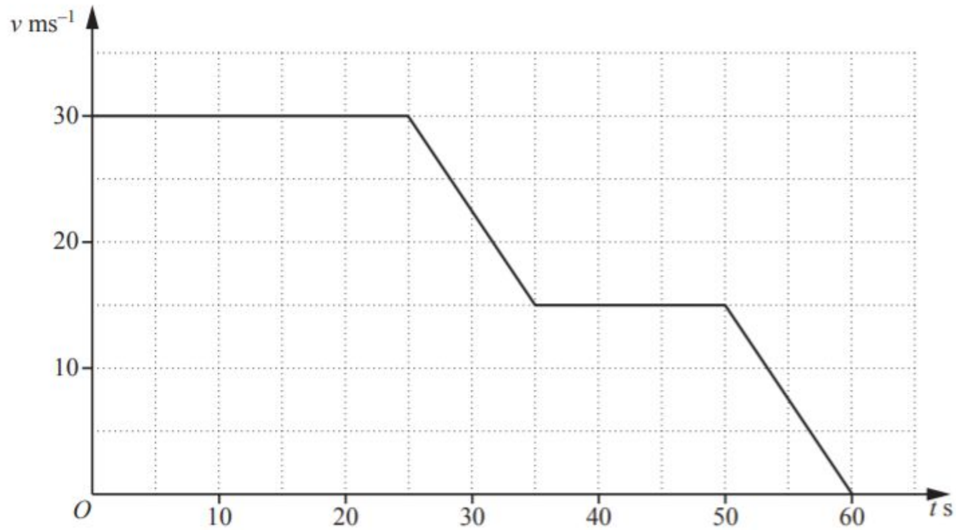
b. The normal to the curve, at point where x=5, meets the line y=- $\frac{5}{3}$ at the point P. Find the x-coordinate of P

Ama 4:


3c) dy/dx = (3x+10)^(-1/2)
∫(3x+10)^(-1/2) dx
= 2(3x+10)^(1/2) / 3 + c
-4/3 = 2(3(2)+10)^(1/2) / 3 + c
-4/3 = 8/3 + c
-4/3 - 8/3 = c
-4 = c
y = 2(3x+10)^(1/2) / 3 - 4
b) (3(5)+10)^(-1/2) = (25)^(-1/2)
= 1/5
m1 . m2 = -1
1/5 . m2 = -1
m2 = -1 ÷ 1/5
= -5 → normal gradient


y = 2(3(5)+10)^(1/2) / 3 - 4
= -2/3
normal → y - y1 = -1/m (x - x1)
y - (-2/3) = -5(x - 5)
y + 2/3 = -5x + 25
y = -5x + 24 1/3
-5/3 = -5x + 24 1/3
5x = 24 1/3 + 5/3
x = 26/5
= 5.2

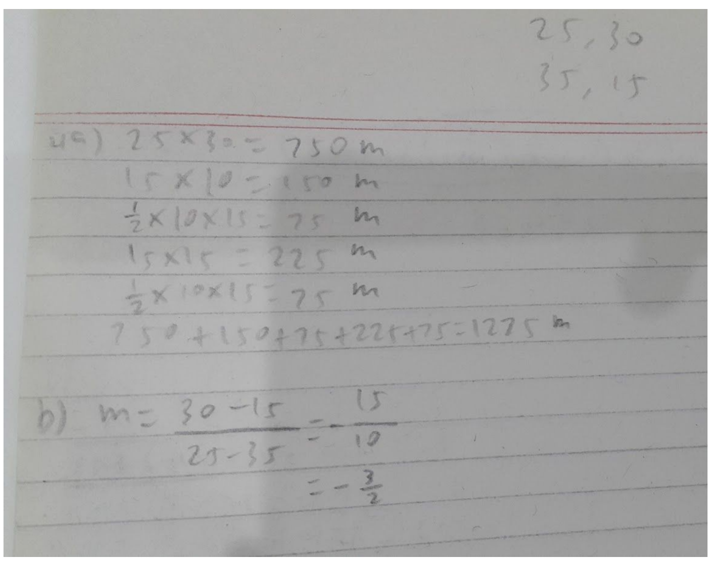
Sep 5:



The diagram shows the velocity-time graph of a particle P moving in a straight line with velocity $v\ ms^{-1}$ at time t s after leaving a fixed point.

a. Find the distance travelled by the particle P
b. Write down the deceleration of the particle when t=30.

Ama :



Ama 1:

i) The first 3 terms, in ascending powers of *x*, in the expansion of $(2 + bx)^2$ can be written as

$a + 256x + cx^2$. Find the value of each of the constants *a*, *b* and *c*.

Kay Extra #1:

Bonus Ques #1

$2C0(2)^2(bx)^0 \rightarrow 4b$

$2C1(2)^1(bx)^1 \rightarrow 4bx$

$2C2(2)^0(bx)^2 \rightarrow b^2x^2$

$4b + 4bx + b^2x^2$

$a + 256x + cx^2$

$4b = 256$

$b = 64$

$a = 4b$

$= 256$

$c = b^2 = (64)^2$

$= 4096$

ans: $a + 256x + cx^2$

$= 256 + 256x + 4096x^2$

$a = 256$

$b = 64$

$c = 4096$

ii) Using the values found in **part (i)**, find the term independent of *x* in the expansion of

$(2 + bx)^8(2x - \frac{3}{x})^2$.

Dyl A1b:

$(2 + 64x)^8(2x - \frac{3}{x})^2$

2^8 + 64(-3) = 64

Ama 2:

The polynomial p(*x*) = (2*x*-1)(*x*+*k*) -12, where *k* is a constant.

i) Write down the value of p(-*k*).

Dyl A2a:

p(-*k*) = (-2k-1)(-*k*+*k*) -12 = -12

When p(*x*) is divided by *x* + 3 the remainder is 23.

ii) Find the value of *k*.

Dyl A2b:

23 = (-6-1)(-3+*k*) -12

K = -2

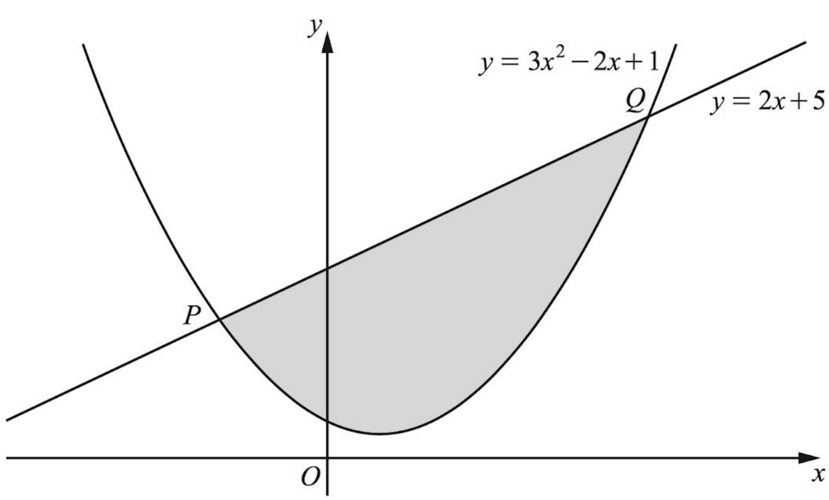
iii) Using your value of *k*, show that the equation p(*x*) = -25 has no real solutions.

Dyl A2c:

-25 = (2*x*-1)(*x*-2) -12 -25 = 2x^2 - 5x + 2 2x^2 - 5x + 27

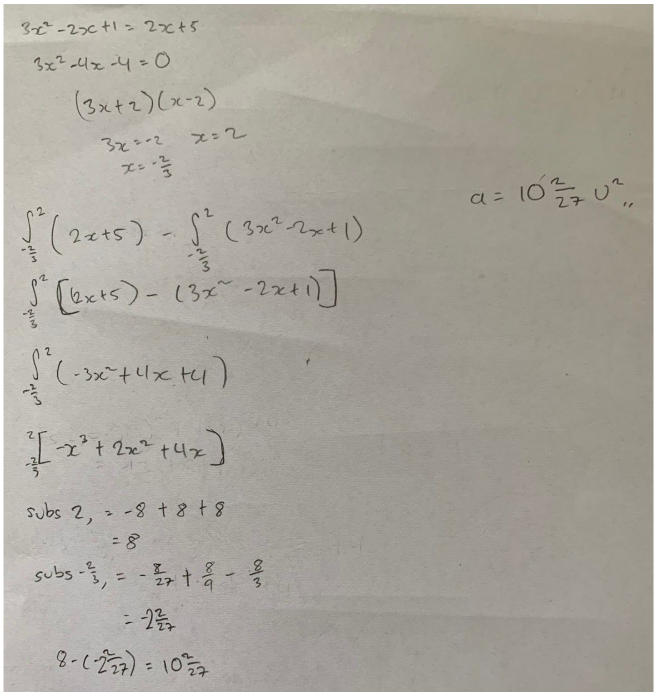
100-4(2)(27)<0 **SHOWN**

Ama 3:



The diagram shows the curve $y = 3x^2 - 2x + 1$ and the straight line $y = 2x + 5$ intersecting at the points P and Q. Showing all your working, find the area of the shaded region. [8]

Rai a1:



$3x^2 - 2x + 1 = 2x + 5$

$3x^2 - 4x - 4 = 0$

$(3x+2)(x-2)$

$3x = -2 \quad x = 2$

$x = -\frac{2}{3}$

$a = 10\frac{2}{27} u^2$

$\int_{-\frac{2}{3}}^{2} (2x+5) - \int_{-\frac{2}{3}}^{2} (3x^2 - 2x + 1)$

$\int_{-\frac{2}{3}}^{2} [(2x+5) - (3x^2 - 2x + 1)]$

$\int_{-\frac{2}{3}}^{2} (-3x^2 + 4x + 4)$

$[-x^3 + 2x^2 + 4x]_{-\frac{2}{3}}^{2}$

subs 2, $= -8 + 8 + 8$

$= 8$

subs $-\frac{2}{3}$, $= -\frac{8}{27} + \frac{8}{9} - \frac{8}{3}$

$= -2\frac{2}{27}$

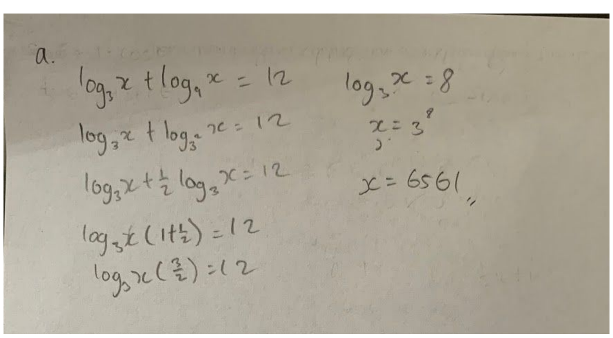
$8 - (-2\frac{2}{27}) = 10\frac{2}{27}$

Ama 4:

a) Solve $log_3 x + log_9 x = 12$

b) Solve $log_4(3y^2 - 10) = 2log_4(y-1) + \frac{1}{2}$

Rai a5:



a.

$\log_3 x + \log_9 x = 12$

$\log_3 x + \log_{3^2} x = 12$

$\log_3 x + \frac{1}{2}\log_3 x = 12$

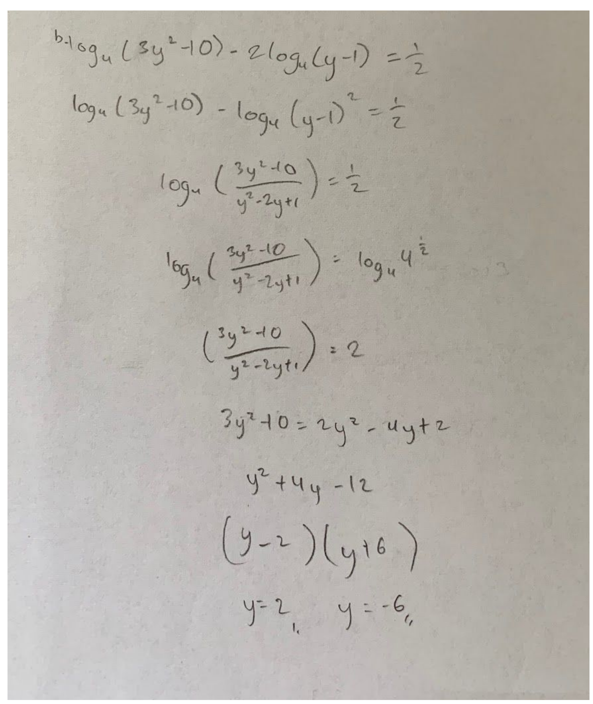
$\log_3 x (1 + \frac{1}{2}) = 12$

$\log_3 x (\frac{3}{2}) = 12$

$\log_3 x = 8$

$x = 3^8$

$x = 6561$



b. $\log_4 (3y^2 - 10) - 2\log_4 (y-1) = \frac{1}{2}$

$\log_4 (3y^2 - 10) - \log_4 (y-1)^2 = \frac{1}{2}$

$\log_4 \left(\frac{3y^2 - 10}{y^2 - 2y + 1}\right) = \frac{1}{2}$

$\log_4 \left(\frac{3y^2 - 10}{y^2 - 2y + 1}\right) = \log_4 4^{\frac{1}{2}}$

$\left(\frac{3y^2 - 10}{y^2 - 2y + 1}\right) = 2$

$3y^2 - 10 = 2y^2 - 4y + 2$

$y^2 + 4y - 12$

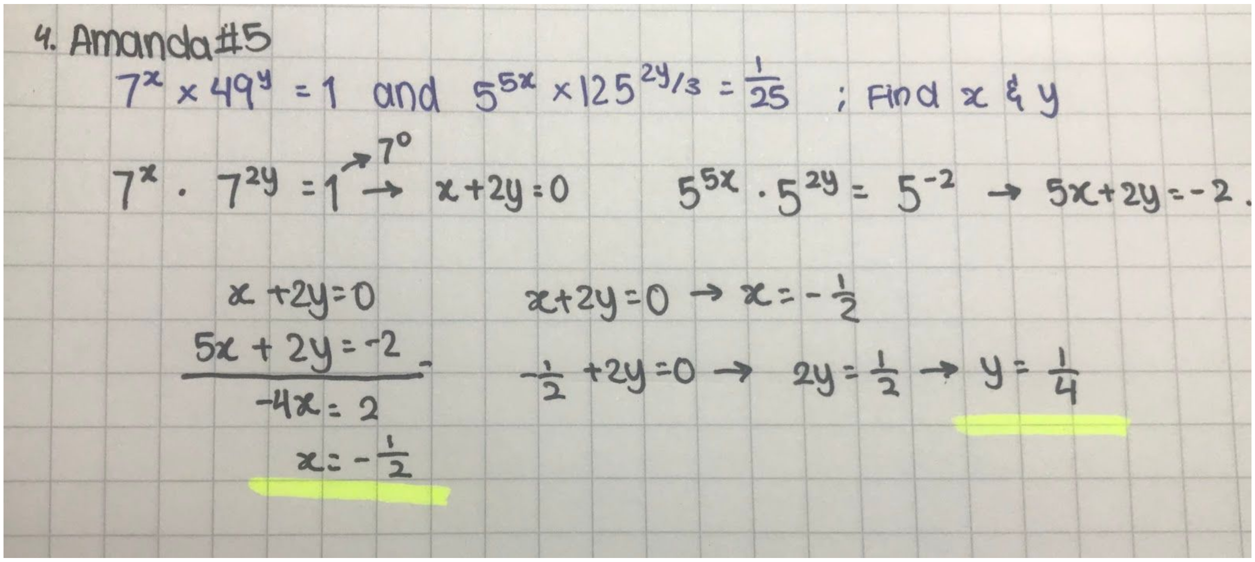
$(y-2)(y+6)$

$y = 2, \quad y = -6$

Ama 5:

Given that $7^x \times 49^y = 1$ and $5^{5x} \times 125^{\frac{2y}{3}} = \frac{1}{25}$, calculate the value of x and y.

Sep a4:



4. Amanda #5

$7^x \times 49^y = 1$ and $5^{5x} \times 125^{2y/3} = \frac{1}{25}$; Find x & y

$7^x \cdot 7^{2y} = 1 \rightarrow x + 2y = 0$ (with $1 \rightarrow 7^0$) $5^{5x} \cdot 5^{2y} = 5^{-2} \rightarrow 5x + 2y = -2$.

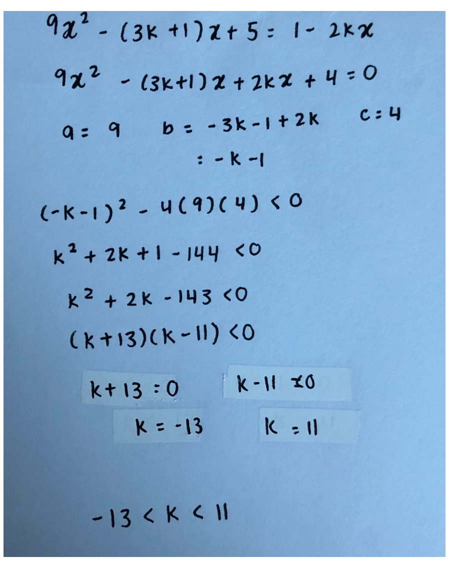
$x + 2y = 0$
$5x + 2y = -2$ −
$-4x = 2$
$x = -\frac{1}{2}$

$x + 2y = 0 \rightarrow x = -\frac{1}{2}$
$-\frac{1}{2} + 2y = 0 \rightarrow 2y = \frac{1}{2} \rightarrow y = \frac{1}{4}$

Cla 1:

Find the values of k for which the line $y = 1 - 2kx$ does not meet the curve $y = 9x^2 - (3k+1)x + 5$.

Kar 5:



$9x^2 - (3k+1)x + 5 = 1 - 2kx$

$9x^2 - (3k+1)x + 2kx + 4 = 0$

$a = 9$ $b = -3k - 1 + 2k$ $c = 4$
$= -k - 1$

$(-k-1)^2 - 4(9)(4) < 0$

$k^2 + 2k + 1 - 144 < 0$

$k^2 + 2k - 143 < 0$

$(k+13)(k-11) < 0$

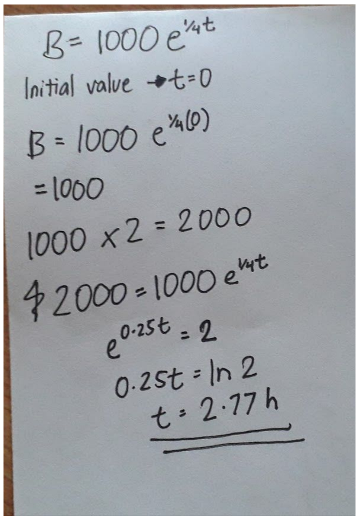
$k + 13 = 0$ $k - 11 = 0$
$k = -13$ $k = 11$

$-13 < k < 11$

Cla 2:

A population, B, of a particular bacterium, t hours after measurements began, is given by $B = 1000e^{1/4t}$. Find the time taken for B to double in size.

Jas 4:



$B = 1000e^{1/4 t}$

Initial value → $t = 0$

$B = 1000\, e^{1/4(0)}$

$= 1000$

$1000 \times 2 = 2000$

$2000 = 1000\, e^{1/4 t}$

$e^{0.25t} = 2$

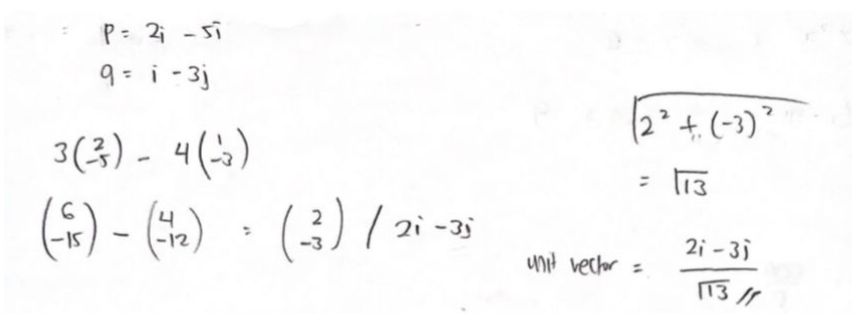
$0.25t = \ln 2$

$t = 2.77\,h$

Cla 3:

Given that $p = 2i - 5j$ and $q = i - 3j$, find the unit vector in the direction of $3p - 4q$.

Ela 3:



$p = 2i - 5i$

$q = i - 3j$

$3\binom{2}{-5} - 4\binom{1}{-3}$

$\binom{6}{-15} - \binom{4}{-12} = \binom{2}{-3}$ / $2i - 3j$

$\sqrt{2^2 + (-3)^2}$

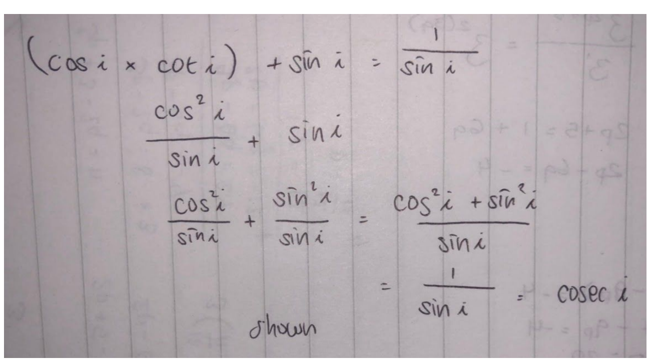
$= \sqrt{13}$

unit vector $= \dfrac{2i - 3j}{\sqrt{13}}$ //

Cla 4:

Show that $cos\ i * cot\ i + sin\ i = cosec\ i$.

Kel A2:



$(\cos i \times \cot i) + \sin i = \dfrac{1}{\sin i}$

$\dfrac{\cos^2 i}{\sin i} + \sin i$

$\dfrac{\cos^2 i}{\sin i} + \dfrac{\sin^2 i}{\sin i} = \dfrac{\cos^2 i + \sin^2 i}{\sin i}$

$= \dfrac{1}{\sin i} = \operatorname{cosec} i$

shown

Cla 5:

It is given that $x+3$ is a factor of the polynomial $p(x) = 2x^3 + ax^2 - 24x + b$. The remainder when $p(x)$ is divided by $x-2$ is -15. Find the remainder when $p(x)$ is divided by $x+1$

Kay 4

4. $2x^3 + ax^2 - 24x + b \div x+3$: 0 remainder

$x+3$, $x=-3$

$2(-3)^3 + a(-3)^2 - 24(-3) + b = 0$

$-54 + 9a + 72 + b = 0$

$18 + 9a + b = 0$

$9a + b = -18$ ← 1st Eq

$2x^3 + ax^2 - 24x + b \div x-2 = -15$ ← remainder

$x-2$, $x=2$

$2(2)^3 + a(2)^2 - 24(2) + b = -15$

$16 + 4a - 48 + b = -15$

$-32 + 4a + b = -15$

$-17 + 4a + b = 0$

$4a + b = 17$ ← 2nd Eq

$9a + b = -18$

$4a + b = 17$ −

$5a = -35$

$a = -7$

$9(-7) + b = -18$

$b = 45$

equation = $p(x) = 2x^3 - 7x^2 - 24x + 45 \div x+1$

$x=-1 \rightarrow 2(-1)^3 - 7(-1)^2 - 24(-1) + 45$

$= -2 - 7 + 24 + 45$

$= 60$ ← final ans!

Kay 1:

Solve the equation $2lgx - lg(\frac{x+10}{2}) = 1$

Cla 3:

$2\log x - \log\left(\frac{x+10}{2}\right) = 1$

$2\log x - \log\left(\frac{x+10}{2}\right) = \log 10$

$\log x^2 - \log\left(\frac{1}{2}x + 5\right) = \log 10$

$\log x^2 = \log 10 + \log\left(\frac{x+10}{2}\right)$

$\log x^2 = \log(5x + 50)$

$x^2 = 5x + 50$

$x^2 - 5x - 50 = 0$

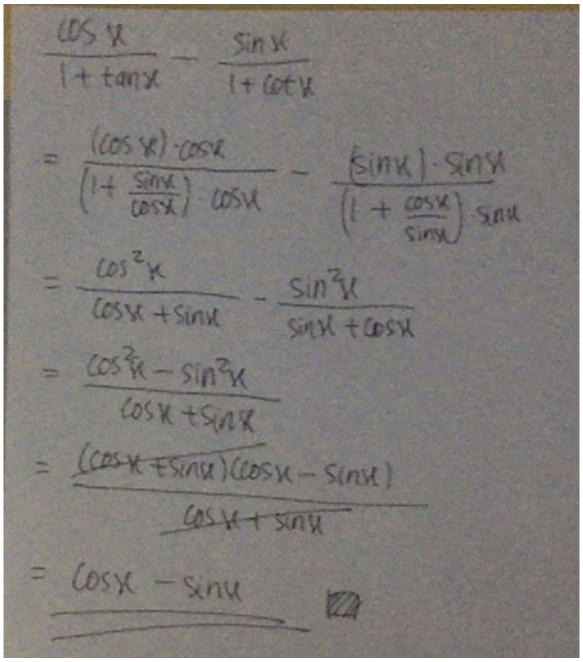
$(x-10)(x+5) = 0$

$x = 10, -5$ //

Kay 2:

Prove that $\frac{\cos x}{1 + \tan x} - \frac{\sin x}{1 + \cot x} = \cos x - \sin x$

Min a2:

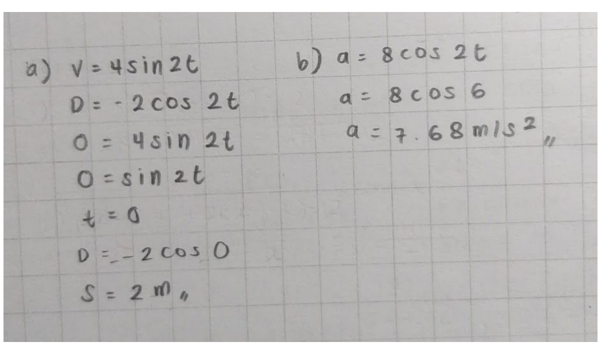


Kay 3:

A particle starts from rest and moves into a straight line so that, t seconds after leaving a point O, it's velocity, vms^{-1}, is given by v = 4 sin 2t

a) Find the distance traveled by the particle before it comes to instantaneous rest
b) Find the acceleration of particle when t=3

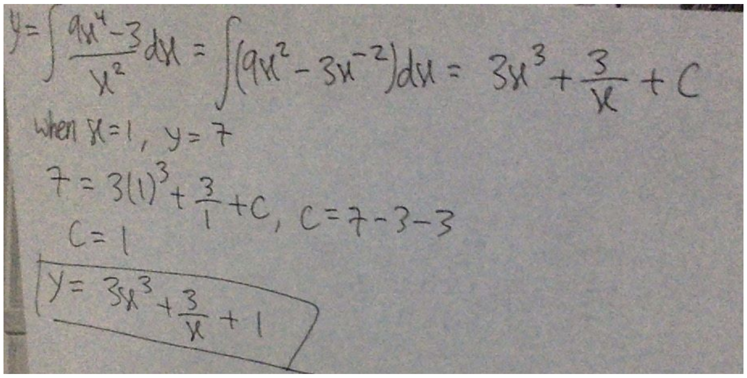
Bri a2:



Kay 4:

Find the equation of the curve which passes through the point (1,7) and for which $\frac{dy}{dx} = \frac{9x^4-3}{x^2}$

Min a1:



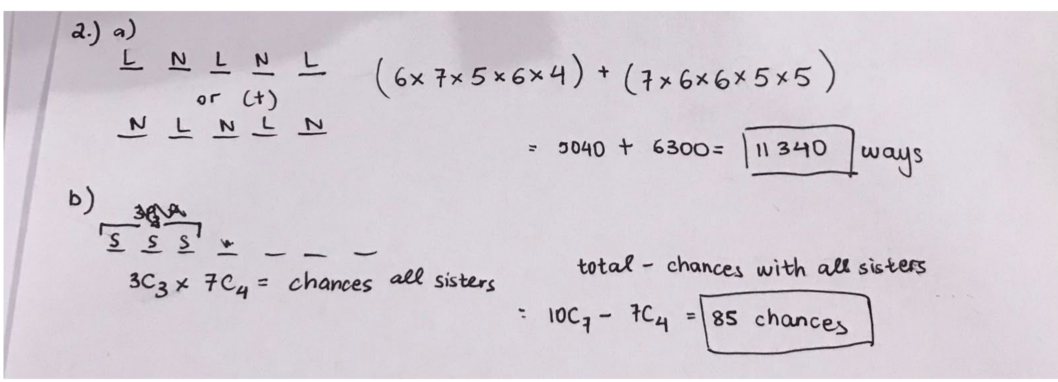
Kay 5:

a) A 5-character code is to be formed from the 13 characters shown below. Each characters may be used once only in any code
   Letters: A, B, C, D, E, F
   Numbers: 1, 2, 3, 4, 5, 6, 7

Find the number of different codes in which no two letters follow each other and no two numbers follow each other

b) A netball team of 7 players is to be chosen from 10 girls. 3 of the girls are sisters. Find the number of different ways the team can be chosen if the team does not contain all 3 sisters

Nat a2:



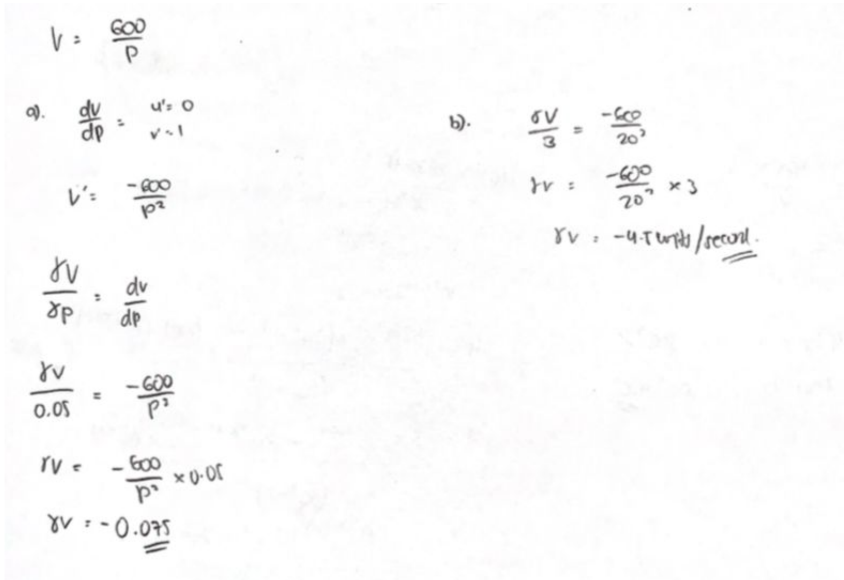
Rai 1:

The volume v of a certain gas varies with the pressure p and is given by v= $\frac{600}{p}$

a) Find $\frac{dv}{dp}$ and hence the approximate decrease in v as p decreases from 20 to 19.95

b) At the instant when p=20, p increases at the rate of 3 units per second. Find the rate of change of v.

Ela 4:



$V = \frac{600}{P}$

a). $\frac{dv}{dp} = \frac{u' = 0}{v' = 1}$

$V' = \frac{-600}{P^2}$

$\frac{\delta v}{\delta p} = \frac{dv}{dp}$

$\frac{\delta v}{0.05} = \frac{-600}{P^2}$

$\delta v = \frac{-600}{P^2} \times 0.05$

$\delta v = -0.075$

b). $\frac{\delta V}{3} = \frac{-600}{20^2}$

$\delta v = \frac{-600}{20^2} \times 3$

$\delta v = -4.5$ units/second.

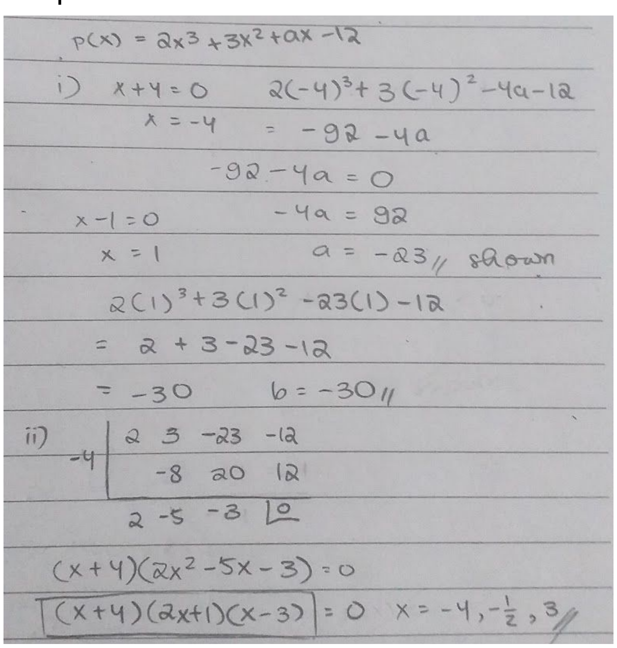
Rai 2:

It is given that x+4 is a factor of p(x)= $2x^3 + 3x^2 + ax - 12$. When p(x) is divided by x-1 te remainder is b

i) show that a=-23 and find the value of the constant b

ii)Factorise p(x) completely and hence state all the solutions for p(x)=0

Cla 4:



$p(x) = 2x^3 + 3x^2 + ax - 12$

i) $x + 4 = 0$ $\quad 2(-4)^3 + 3(-4)^2 - 4a - 12$

$x = -4$ $\quad = -92 - 4a$

$-92 - 4a = 0$

$x - 1 = 0$ $\quad -4a = 92$

$x = 1$ $\quad a = -23$ // shown

$2(1)^3 + 3(1)^2 - 23(1) - 12$

$= 2 + 3 - 23 - 12$

$= -30$ $\quad b = -30$ //

ii)

-4	2	3	-23	-12
		-8	20	12
	2	-5	-3	0

$(x+4)(2x^2 - 5x - 3) = 0$

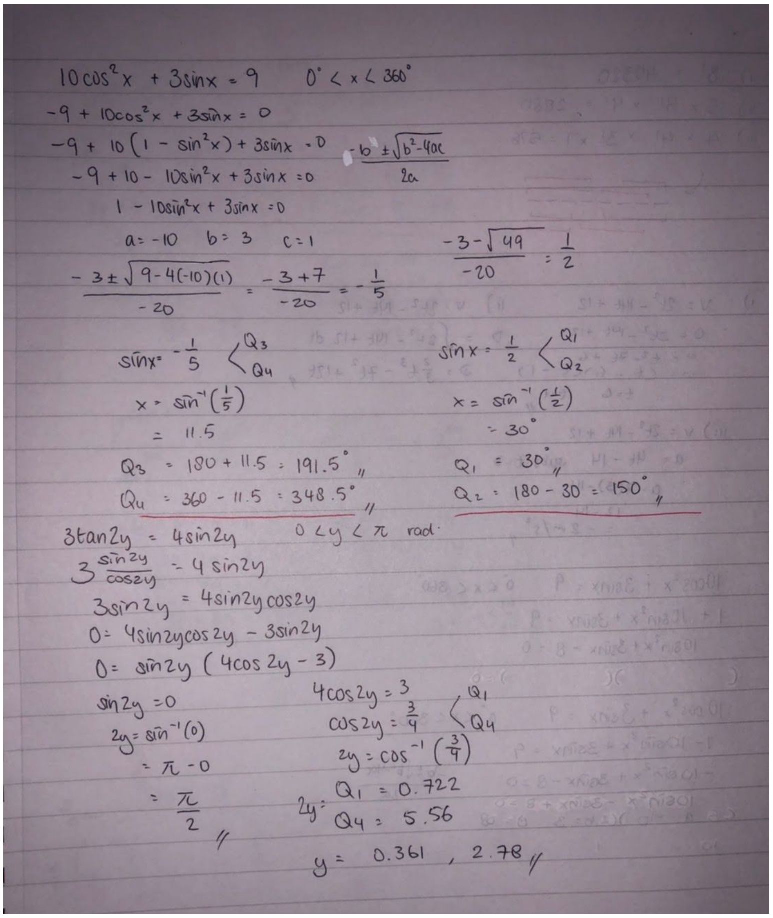
$(x+4)(2x+1)(x-3) = 0$ $\quad x = -4, -\frac{1}{2}, 3$ //

Rai 3:

a) Solve $10cos^2x + 3sinx = 9$ for 0°< x < 360°

b) Solve $3tan2y = 4sin2y$ for 0<y<π radians

Kel A5:



$10\cos^2 x + 3\sin x = 9 \quad 0° < x < 360°$

$-9 + 10\cos^2 x + 3\sin x = 0$

$-9 + 10(1 - \sin^2 x) + 3\sin x = 0 \qquad \frac{-b \pm \sqrt{b^2-4ac}}{2a}$

$-9 + 10 - 10\sin^2 x + 3\sin x = 0$

$1 - 10\sin^2 x + 3\sin x = 0$

$a = -10 \quad b = 3 \quad c = 1$

$\frac{-3 \pm \sqrt{9-4(-10)(1)}}{-20} = \frac{-3+7}{-20} = -\frac{1}{5} \qquad \frac{-3-\sqrt{49}}{-20} = \frac{1}{2}$

$\sin x = -\frac{1}{5}$ (Q3, Q4) $\qquad \sin x = \frac{1}{2}$ (Q1, Q2)

$x = \sin^{-1}(\frac{1}{5}) = 11.5 \qquad x = \sin^{-1}(\frac{1}{2}) = 30°$

$Q_3 = 180 + 11.5 = 191.5°$ // $\qquad Q_1 = 30°$ //

$Q_4 = 360 - 11.5 = 348.5°$ // $\qquad Q_2 = 180 - 30 = 150°$ //

$3\tan 2y = 4\sin 2y \quad 0 < y < \pi$ rad

$3\frac{\sin 2y}{\cos 2y} = 4\sin 2y$

$3\sin 2y = 4\sin 2y\cos 2y$

$0 = 4\sin 2y\cos 2y - 3\sin 2y$

$0 = \sin 2y(4\cos 2y - 3)$

$\sin 2y = 0 \qquad 4\cos 2y = 3$

$2y = \sin^{-1}(0) \qquad \cos 2y = \frac{3}{4}$ (Q1, Q4)

$= \pi - 0 \qquad 2y = \cos^{-1}(\frac{3}{4})$

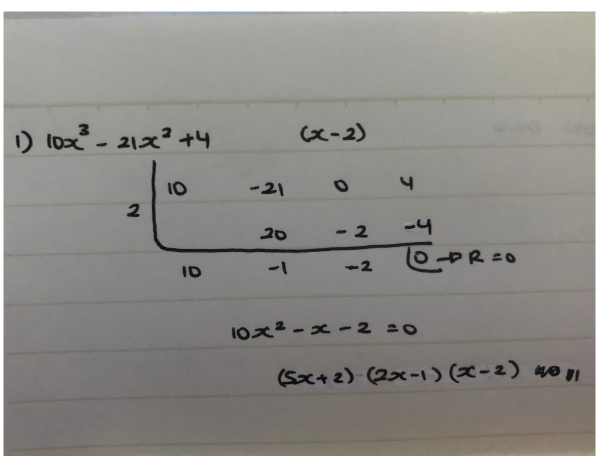
$= \frac{\pi}{2}$ // $\qquad 2y: Q_1 = 0.722, \; Q_4 = 5.56$

$y = 0.361, \; 2.78$ //

Rai 4:

Without using a calculator, factorise the expression $10x^3 - 21x^2 + 4$

Haz 1:



1) $10x^3 - 21x^2 + 4 \qquad (x-2)$

2	10	-21	0	4
		20	-2	-4
	10	-1	-2	0 → R = 0

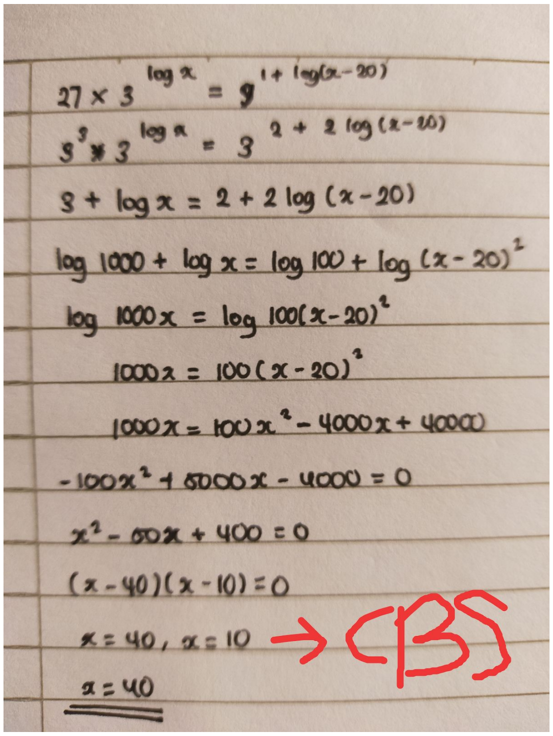
$10x^2 - x - 2 = 0$

$(5x+2)(2x-1)(x-2)$ //

Rai 5:

Find x for which $27 \times 3^{\log x} = 9^{1+\log(x-20)}$

Sac 3


$27 \times 3^{\log x} = 9^{1+\log(x-20)}$

$3^3 \times 3^{\log x} = 3^{2+2\log(x-20)}$

$3 + \log x = 2 + 2\log(x-20)$

$\log 1000 + \log x = \log 100 + \log(x-20)^2$

$\log 1000x = \log 100(x-20)^2$

$1000x = 100(x-20)^2$

$1000x = 100x^2 - 4000x + 40000$

$-100x^2 + 5000x - 4000 = 0$

$x^2 - 50x + 400 = 0$

$(x-40)(x-10) = 0$

$x = 40,\ x = 10$ → (B)

$x = 40$

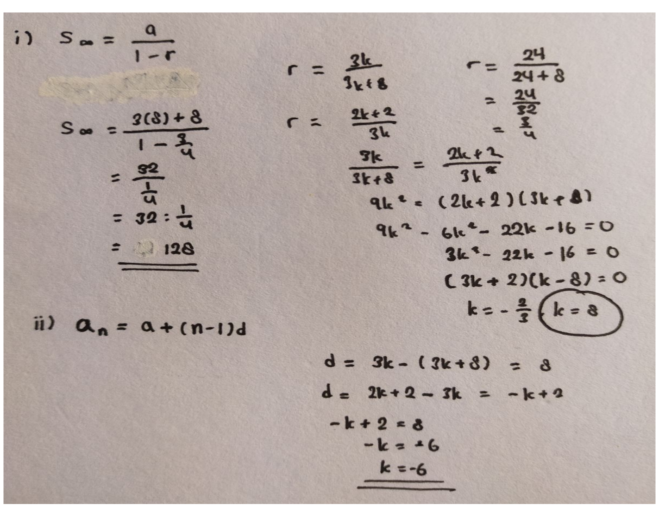
Gis 1:

The 1*st,* 4*th* and 16*th* term of an arithmetic progression are 3*k*+8, 3*k*, 2*k*+2 respectively, where *k* is a positive constant.

i) In case the progression is geometric, find the value of *k*. Hence, or otherwise, find the sum to infinity of the progression.

ii) In case the progression is arithmetic, find the value of *k*.

Sac 1


i) $S_\infty = \frac{a}{1-r}$

$S_\infty = \frac{3(8)+8}{1-\frac{3}{4}} = \frac{32}{\frac{1}{4}} = 32 \div \frac{1}{4} = 128$

$r = \frac{3k}{3k+8}$

$r = \frac{2k+2}{3k}$

$\frac{3k}{3k+8} = \frac{2k+2}{3k}$

$9k^2 = (2k+2)(3k+8)$

$9k^2 - 6k^2 - 22k - 16 = 0$

$3k^2 - 22k - 16 = 0$

$(3k+2)(k-8) = 0$

$k = -\frac{2}{3}$, $k = 8$

$r = \frac{24}{24+8} = \frac{24}{32} = \frac{3}{4}$

ii) $a_n = a + (n-1)d$

$d = 3k - (3k+8) = 8$

$d = 2k+2 - 3k = -k+2$

$-k + 2 = 8$

$-k = 6$

$k = -6$

Gis 2:

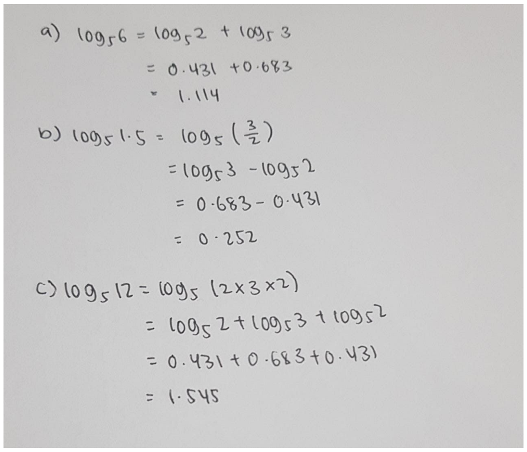
Given that $log_5 2 = 0.431$ and $log_5 3 = 0.683$, find the value of

a) $log_5 6$

b) $log_5 1.5$

c) $log_5 12$

Mei a2



a) $\log_5 6 = \log_5 2 + \log_5 3$

$= 0.431 + 0.683$

$= 1.114$

b) $\log_5 1.5 = \log_5 \left(\frac{3}{2}\right)$

$= \log_5 3 - \log_5 2$

$= 0.683 - 0.431$

$= 0.252$

c) $\log_5 12 = \log_5 (2 \times 3 \times 2)$

$= \log_5 2 + \log_5 3 + \log_5 2$

$= 0.431 + 0.683 + 0.431$

$= 1.545$

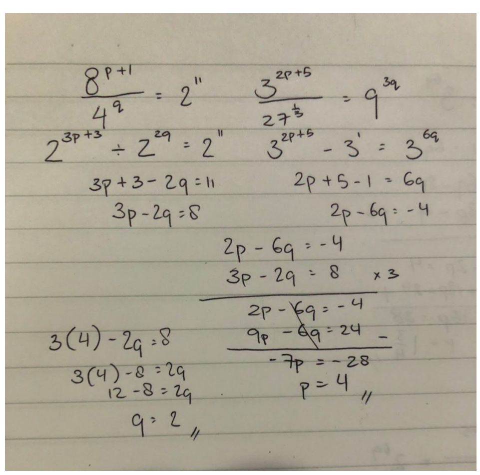
Nat 1:

Solve the simultaneous equations

$$\frac{8^{p+1}}{4^{q}} = 2^{11},$$

$$\frac{3^{2p+5}}{27^{\frac{1}{3}}} = 9^{3q}$$

Kel A1:



$\frac{8^{p+1}}{4^q} = 2^{11}$ $\qquad$ $\frac{3^{2p+5}}{27^{\frac{1}{3}}} = 9^{3q}$

$2^{3p+3} \div 2^{2q} = 2^{11}$ $\qquad$ $3^{2p+5} - 3^{1} = 3^{6q}$

$3p + 3 - 2q = 11$ $\qquad$ $2p + 5 - 1 = 6q$

$3p - 2q = 8$ $\qquad$ $2p - 6q = -4$

$2p - 6q = -4$

$3p - 2q = 8 \quad \times 3$

$2p - 6q = -4$

$9p - 6q = 24 \quad -$

$-7p = -28$

$p = 4$

$3(4) - 2q = 8$

$3(4) - 8 = 2q$

$12 - 8 = 2q$

$q = 2$

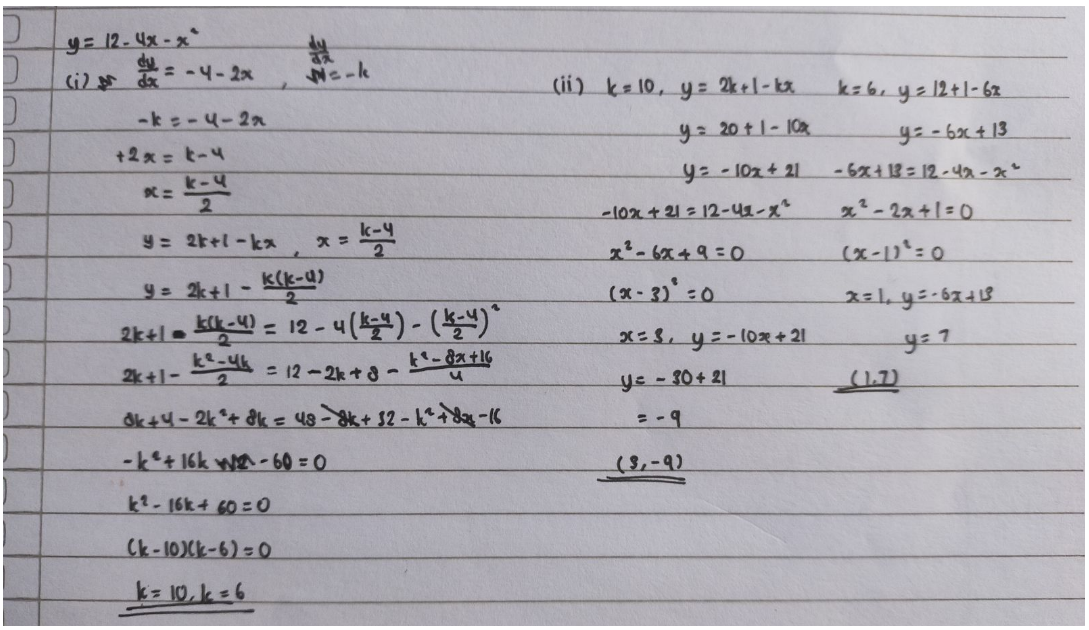
Nat 2:

Two lines are tangents to the curve $y = 12 - 4x - x^2$. The equation of each tangent is of the form $y = 2k + 1 - kx$, where k is a constant.

(i) Find the two possible values of k.

(ii) Find the coordinates of the point of intersection of the two tangents

Sac 5



$y = 12 - 4x - x^2$

(i) $\frac{dy}{dx} = -4 - 2x$, $\frac{dy}{dx} = -k$

$-k = -4 - 2x$

$+2x = k - 4$

$x = \frac{k-4}{2}$

$y = 2k + 1 - kx$, $x = \frac{k-4}{2}$

$y = 2k + 1 - \frac{k(k-4)}{2}$

$2k + 1 - \frac{k(k-4)}{2} = 12 - 4\left(\frac{k-4}{2}\right) - \left(\frac{k-4}{2}\right)^2$

$2k + 1 - \frac{k^2 - 4k}{2} = 12 - 2k + 8 - \frac{k^2 - 8x + 16}{4}$

$8k + 4 - 2k^2 + 8k = 48 - 8k + 32 - k^2 + 8x - 16$

$-k^2 + 16k - 60 = 0$

$k^2 - 16k + 60 = 0$

$(k-10)(k-6) = 0$

$k = 10, k = 6$

(ii) $k = 10$, $y = 2k + 1 - kx$

$y = 20 + 1 - 10x$

$y = -10x + 21$

$-10x + 21 = 12 - 4x - x^2$

$x^2 - 6x + 9 = 0$

$(x-3)^2 = 0$

$x = 3$, $y = -10x + 21$

$y = -30 + 21$

$= -9$

$(3, -9)$

$k = 6$, $y = 12 + 1 - 6x$

$y = -6x + 13$

$-6x + 13 = 12 - 4x - x^2$

$x^2 - 2x + 1 = 0$

$(x-1)^2 = 0$

$x = 1$, $y = -6x + 13$

$y = 7$

$(1, 7)$

Nat 3:

The polynomial $p(x) = ax^3 + 17x^2 + bx - 8$ is divisible by $2x-1$ and has a remainder of -35 when divided by $x + 3$.

(i) By finding the value of each of the constants a and b, verify that $a = b$.

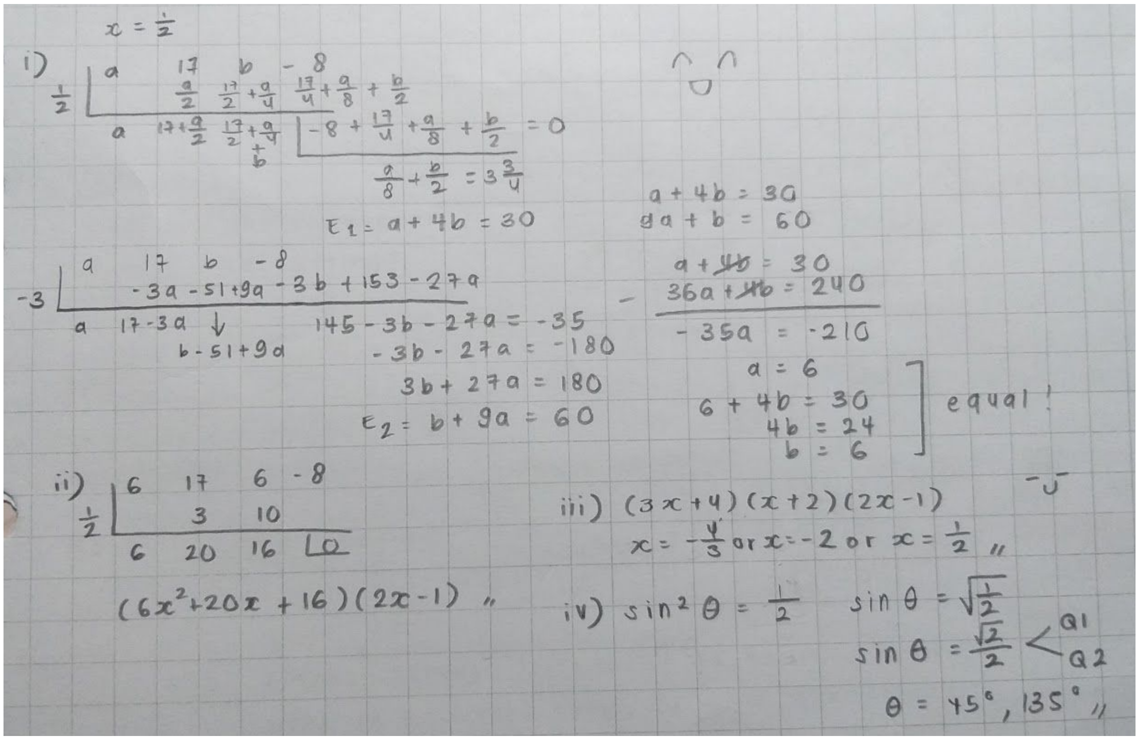
Using your values of a and b,

(ii) find $p(x)$ in the form $(2x-1)q(x)$, where $q(x)$ is a quadratic expression

(iii) factorise $p(x)$ completely

(iv) solve $asin^3\theta + 17sin^2\theta + bsin\theta - 8 = 0 \quad for \quad 0 \circ < \theta < 180 \circ$

Bri a1:



$x = \frac{1}{2}$

i) Synthetic division by $\frac{1}{2}$ of $a \quad 17 \quad b \quad -8$:

$-8 + \frac{17}{4} + \frac{a}{8} + \frac{b}{2} = 0$

$\frac{a}{8} + \frac{b}{2} = 3\frac{3}{4}$

$E_1 = a + 4b = 30$

Synthetic division by -3 of $a \quad 17 \quad b \quad -8$:

$-3a \quad -51+9a \quad -3b+153-27a$

$a \quad 17-3a \quad b-51+9a$

$145 - 3b - 27a = -35$

$-3b - 27a = -180$

$3b + 27a = 180$

$E_2 = b + 9a = 60$

$a + 4b = 30$

$9a + b = 60$

$a + 4b = 30$

$36a + 4b = 240$

$-35a = -210$

$a = 6$

$6 + 4b = 30$

$4b = 24$

$b = 6$

equal!

ii) Synthetic division by $\frac{1}{2}$ of $6 \quad 17 \quad 6 \quad -8$:

$3 \quad 10$

$6 \quad 20 \quad 16 \quad 0$

$(6x^2 + 20x + 16)(2x - 1)$

iii) $(3x+4)(x+2)(2x-1)$

$x = -\frac{4}{3}$ or $x = -2$ or $x = \frac{1}{2}$

iv) $\sin^2\theta = \frac{1}{2}$

$\sin\theta = \sqrt{\frac{1}{2}}$

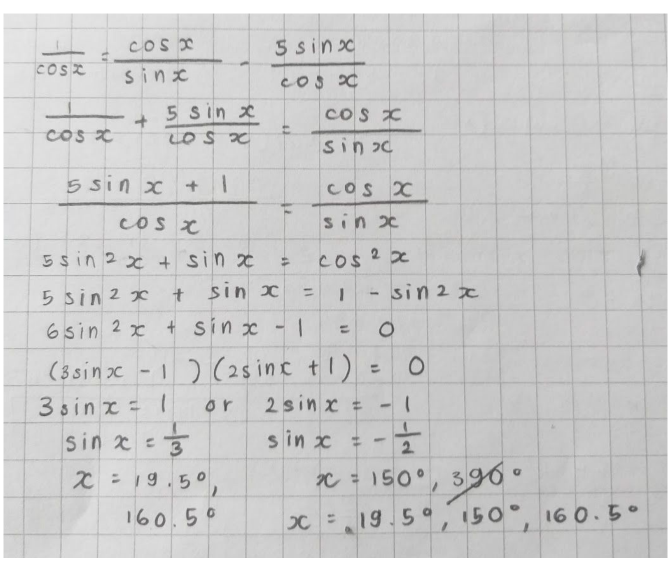
$\sin\theta = \frac{\sqrt{2}}{2}$ < Q1, Q2

$\theta = 45°, 135°$

Nat 4:

Solve $sec\, x = cot\, x - 5\, tan\, x \quad for \quad 0 \circ < x < 360 \circ$

Bri a5:



$\frac{1}{\cos x} = \frac{\cos x}{\sin x} - \frac{5\sin x}{\cos x}$

$\frac{1}{\cos x} + \frac{5\sin x}{\cos x} = \frac{\cos x}{\sin x}$

$\frac{5\sin x + 1}{\cos x} = \frac{\cos x}{\sin x}$

$5\sin^2 x + \sin x = \cos^2 x$

$5\sin^2 x + \sin x = 1 - \sin^2 x$

$6\sin^2 x + \sin x - 1 = 0$

$(3\sin x - 1)(2\sin x + 1) = 0$

$3\sin x = 1$ or $2\sin x = -1$

$\sin x = \frac{1}{3}$ $\quad \sin x = -\frac{1}{2}$

$x = 19.5°, 160.5°$ $\quad x = 150°$, ~~390°~~

$x = 19.5°, 150°, 160.5°$

Nat 5:

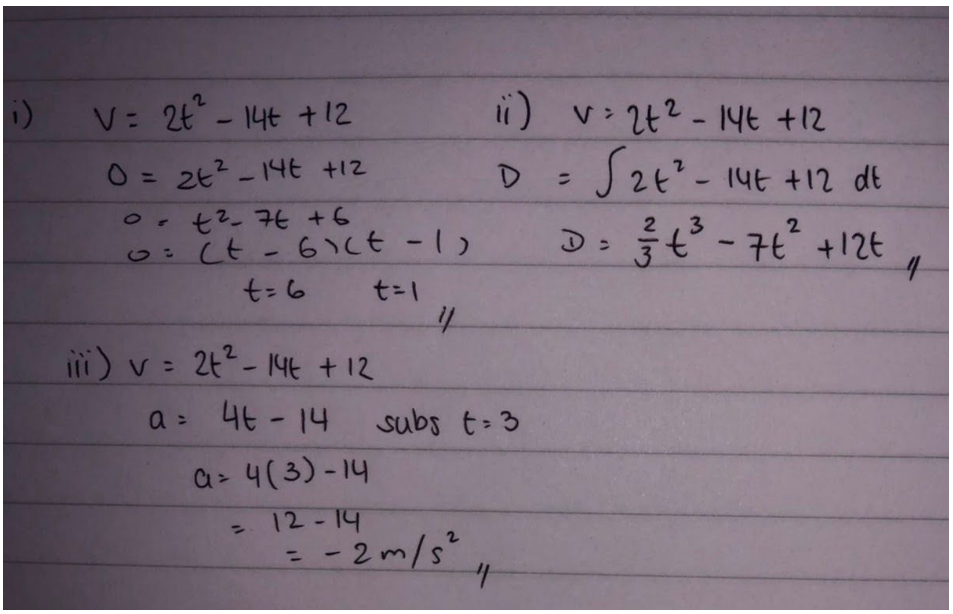
A particle P is projected from the origin O so that it moves in a straight line. At time t seconds after projection, the velocity of the particle, v ms^{-1}, is given by
$v = 2t^2 - 14t + 12$

(i) Find the time at which P first comes to instantaneous rest.

(ii) Find an expression for the displacement of P from O at time t seconds.

(iii) Find the acceleration of P when $t = 3$.

Kel a4:



i) $V = 2t^2 - 14t + 12$

$0 = 2t^2 - 14t + 12$

$0 = t^2 - 7t + 6$

$0 = (t - 6)(t - 1)$

$t = 6 \quad t = 1$ //

ii) $v = 2t^2 - 14t + 12$

$D = \int 2t^2 - 14t + 12 \, dt$

$D = \frac{2}{3}t^3 - 7t^2 + 12t$ //

iii) $v = 2t^2 - 14t + 12$

$a = 4t - 14$ subs $t = 3$

$a = 4(3) - 14$

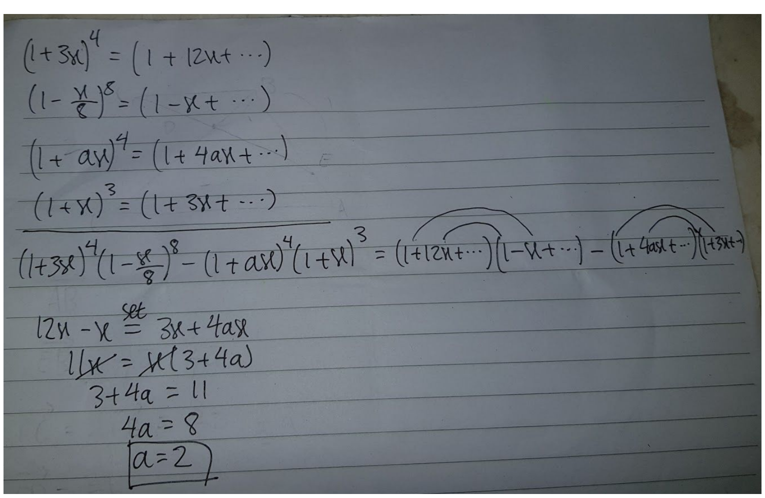
$= 12 - 14$

$= -2 \text{ m/s}^2$ //

Kel 1:

Find a if the coefficient of x in the expansion of $(1 + 3x)^4\ (1 - x/8)^8 - (1 + ax)^4(1 + x)^3$ is zero.

Min a5:



$(1+3x)^4 = (1 + 12x + \cdots)$

$(1 - \frac{x}{8})^8 = (1 - x + \cdots)$

$(1 + ax)^4 = (1 + 4ax + \cdots)$

$(1 + x)^3 = (1 + 3x + \cdots)$

$(1+3x)^4(1-\frac{x}{8})^8 - (1+ax)^4(1+x)^3 = (1+12x+\cdots)(1-x+\cdots) - (1+4ax+\cdots)(1+3x+\cdots)$

$12x - x \overset{\text{set}}{=} 3x + 4ax$

$11x = x(3+4a)$

$3 + 4a = 11$

$4a = 8$

$\boxed{a = 2}$

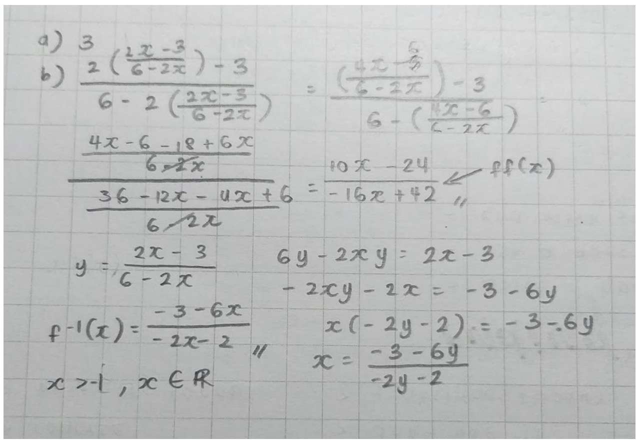
Kel 2:

a function f(x)= $\frac{2x-3}{6-2x}$

a) What is the value of x that cannot be substituted into the function?

b) Find ff(x) and $f^{-1}(x)$ and determine which domain x is not allowed.

Bri a3:



a) 3

b) $\frac{2\left(\frac{2x-3}{6-2x}\right)-3}{6-2\left(\frac{2x-3}{6-2x}\right)} = \frac{\left(\frac{4x-6}{6-2x}\right)-3}{6-\left(\frac{4x-6}{6-2x}\right)}$

$\frac{\frac{4x-6-18+6x}{6-2x}}{\frac{36-12x-4x+6}{6-2x}} = \frac{10x-24}{-16x+42}$ ← ff(x)

$y = \frac{2x-3}{6-2x}$

$6y - 2xy = 2x - 3$

$-2xy - 2x = -3 - 6y$

$x(-2y-2) = -3-6y$

$x = \frac{-3-6y}{-2y-2}$

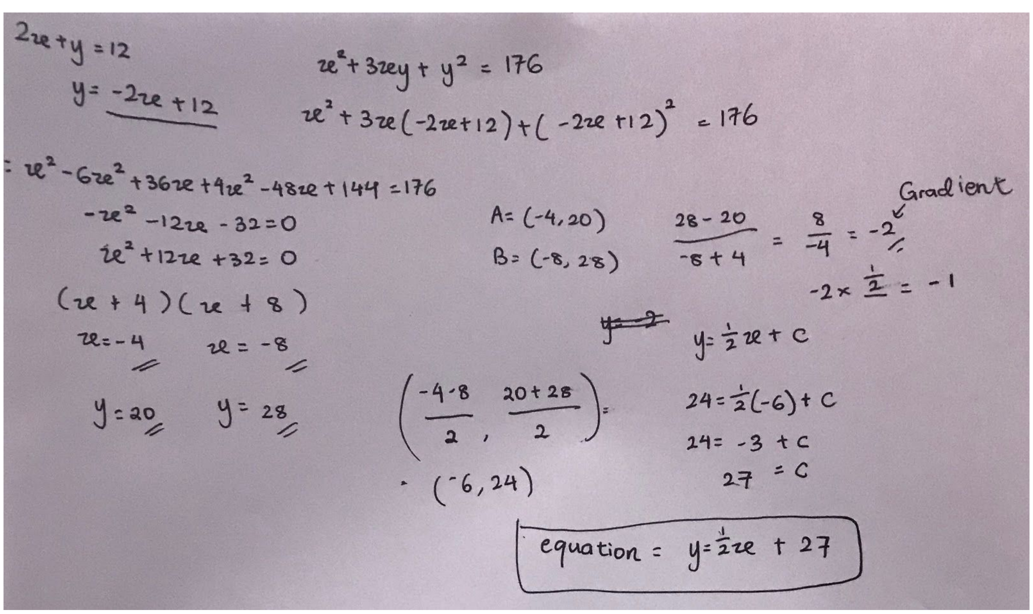
$f^{-1}(x) = \frac{-3-6x}{-2x-2}$

$x > -1, x \in R$

Kel 3:

the line 2x + y = 12 intersects the curve $x^2 + 3xy + y^2 = 176$ at the points A and B. find the equation of the perpendicular bisector.

Nat a1:



$2x + y = 12$

$y = -2x + 12$

$x^2 + 3xy + y^2 = 176$

$x^2 + 3x(-2x+12) + (-2x+12)^2 = 176$

$= x^2 - 6x^2 + 36x + 4x^2 - 48x + 144 = 176$

$-x^2 - 12x - 32 = 0$

$x^2 + 12x + 32 = 0$

$(x+4)(x+8)$

$x = -4$ $x = -8$

$y = 20$ $y = 28$

A= (-4, 20)

B= (-8, 28)

Gradient: $\frac{28-20}{-8+4} = \frac{8}{-4} = -2$

$-2 \times \frac{1}{2} = -1$

$\left(\frac{-4-8}{2}, \frac{20+28}{2}\right) = (-6, 24)$

$y = \frac{1}{2}x + c$

$24 = \frac{1}{2}(-6) + c$

$24 = -3 + c$

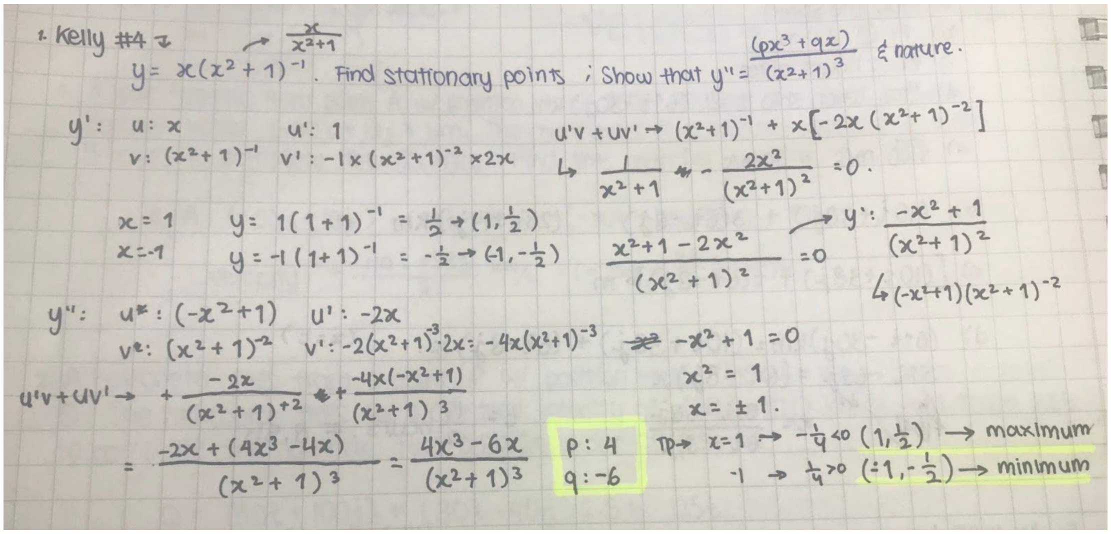
$27 = c$

equation: $y = \frac{1}{2}x + 27$

Kel 4:

A curve has the equation $y = x\,(x^2+1)^{-1}$. Find the coordinates of the stationary points of the curve. Show that y''= $\frac{(px^3+qx)}{(x^2+1)^3}$ where p and q are integers to be found, and determine the nature of the stationary points of the curve.

Sep a1:


1. Kelly #4

$y = x(x^2+1)^{-1}$ → $\frac{x}{x^2+1}$. Find stationary points ; Show that $y'' = \frac{(px^3+qx)}{(x^2+1)^3}$ & nature.

y': u: x u': 1

v: $(x^2+1)^{-1}$ v': $-1 \times (x^2+1)^{-2} \times 2x$

u'v + uv' → $(x^2+1)^{-1} + x[-2x(x^2+1)^{-2}]$

↳ $\frac{1}{x^2+1} - \frac{2x^2}{(x^2+1)^2} = 0.$

$\frac{x^2+1-2x^2}{(x^2+1)^2} = 0$ → y': $\frac{-x^2+1}{(x^2+1)^2}$

↳ $(-x^2+1)(x^2+1)^{-2}$

$-x^2+1=0$

$x^2 = 1$

$x = \pm 1.$

x = 1 $y = 1(1+1)^{-1} = \frac{1}{2} \rightarrow (1, \frac{1}{2})$

x = -1 $y = -1(1+1)^{-1} = -\frac{1}{2} \rightarrow (-1, -\frac{1}{2})$

y'': u: $(-x^2+1)$ u': $-2x$

v: $(x^2+1)^{-2}$ v': $-2(x^2+1)^{-3} \cdot 2x = -4x(x^2+1)^{-3}$

u'v + uv' → $\frac{-2x}{(x^2+1)^{+2}} + \frac{-4x(-x^2+1)}{(x^2+1)^3}$

$= \frac{-2x + (4x^3 - 4x)}{(x^2+1)^3} = \frac{4x^3-6x}{(x^2+1)^3}$

p: 4

q: -6

TP→ x = 1 → $-\frac{1}{4} < 0$ $(1, \frac{1}{2})$ → maximum

-1 → $\frac{1}{4} > 0$ $(-1, -\frac{1}{2})$ → minimum

Kel 5:

Solve the simultaneous equation $log_2(x+2y) = 3$ and $log_2 3x - log_2 y = 1$

Haz 2:

$$10x^2 - x - 2 = 0$$

$$(5x+2)(2x-1)(x-2) \neq 0$$

2) $\log_2(x+2y) = 3$ $\qquad$ $\log_2 3x - \log_2 y = 1$

$\log_2(x+2y) = \log_2 8$ $\qquad$ $\log_2\left(\frac{3x}{y}\right) = \log_2 2$

$x + 2y = 8$ $\qquad$ $\frac{3x}{y} = 2$

$x = 8 - 2y$ $\qquad$ $\frac{3(8-2y)}{y} = 2$

$24 - 6y = 2y$

$24 = 8y$

$y = 3$

$x + 2y = 8$

$x + 2(3) = 8$

$x + 6 = 8$

$x = 2$

4) i) $\sqrt{7^2 + 24^2} = 25$

ii) $\sqrt{3^2 + (-4)^2} = 5$

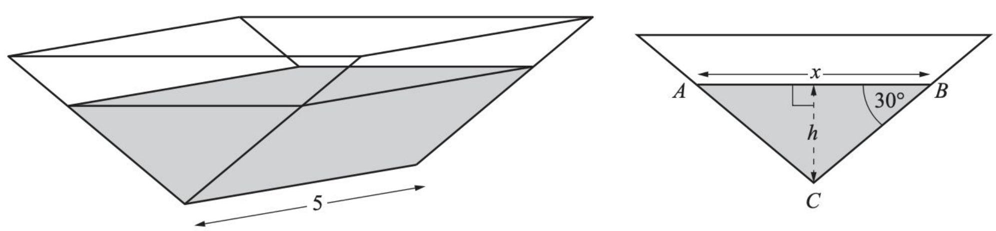
iii) $\vec{AC} = \vec{OA}$

$\vec{AC} = 25$

$\vec{AC} = 5\vec{AB} = \begin{pmatrix} 15 \\ -20 \end{pmatrix}$

Bri 1:

12 In this question all lengths are in metres.



A water container is in the shape of a triangular prism. The diagrams show the container and its cross-section. The cross-section of the water in the container is an isosceles triangle ABC, with angle ABC = angle BAC = 30°. The length of AB is x and the depth of water is h. The length of the container is 5.

Show that x=2√3h and hence find the volume of the water in the container in terms of h.

Sac 4

$\tan 30° = \frac{x/2}{h}$

So, $x = 2\sqrt{3}h$ Shown!

Volume = BA · h

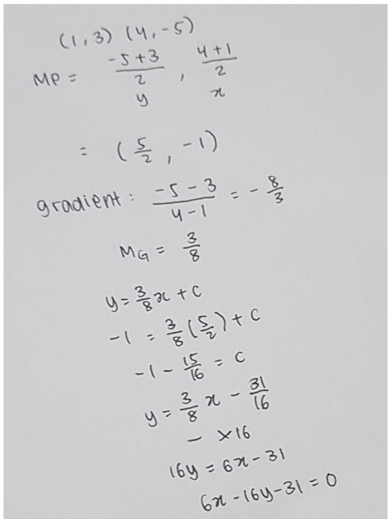
$= \left(\frac{1}{2} \times 2\sqrt{3}h \times h\right) \times 5$

$= \sqrt{3}h^2 \times 5$

$= \left(5\sqrt{3}h^2\right) m^2$

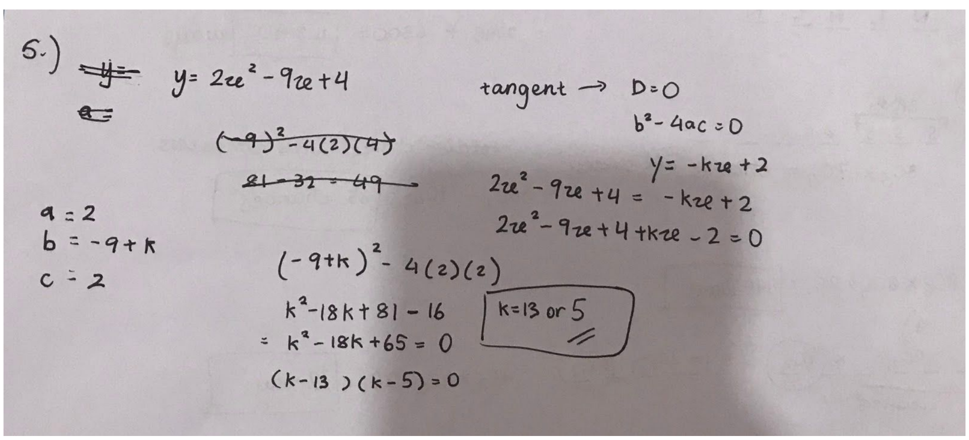
Bri 2:
Find the equation of the perpendicular bisector of the line joining the points (1, 3) and (4, -5). Give your answer in the form ax + by + c = 0, where a, b and c are integers.

Mei a3:


(1, 3) (4, -5)
$MP = \frac{-5+3}{2}$ (y) , $\frac{4+1}{2}$ (x)
$= (\frac{5}{2}, -1)$
gradient : $\frac{-5-3}{4-1} = -\frac{8}{3}$
$M_G = \frac{3}{8}$
$y = \frac{3}{8}x + c$
$-1 = \frac{3}{8}(\frac{5}{2}) + c$
$-1 - \frac{15}{16} = c$
$y = \frac{3}{8}x - \frac{31}{16}$
$\times 16$
$16y = 6x - 31$
$6x - 16y - 31 = 0$

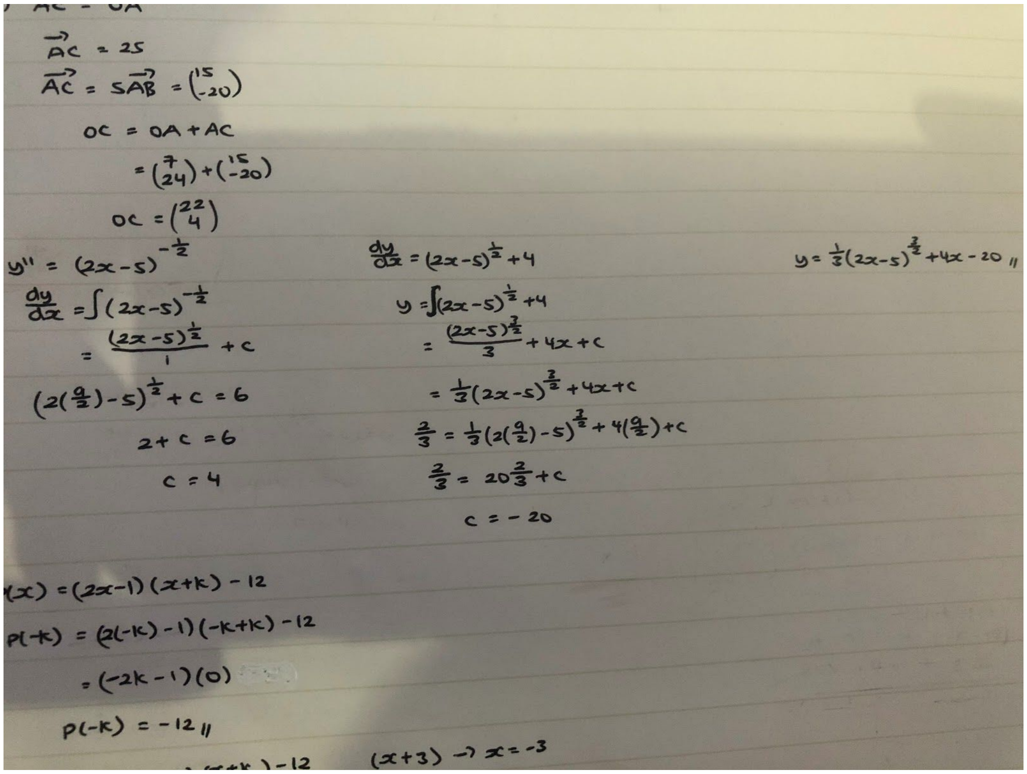
Bri 3:
Find the values of k for which the line y + kx - 2 = 0 is a tangent to the curve y = $2x^2 - 9x + 4$.

Nat a5:


5.) $y = 2x^2 - 9x + 4$
~~$(-9)^2 - 4(2)(4)$~~
~~$81 - 32 = 49$~~
tangent → D=0
$b^2 - 4ac = 0$
$y = -kx + 2$
$2x^2 - 9x + 4 = -kx + 2$
$2x^2 - 9x + 4 + kx - 2 = 0$
a = 2
b = -9 + k
c = 2
$(-9+k)^2 - 4(2)(2)$
$k^2 - 18k + 81 - 16$
$= k^2 - 18k + 65 = 0$
$(k-13)(k-5) = 0$
k = 13 or 5 //

Bri 4:
A curve is such that y” = (2x-5)^-½. Given that the curve has a gradient of 6 at the point (9/2, 2/3), find the equation of the curve. [y” = second derivative]

Haz 5:



$\vec{AC} = 25$

$\vec{AC} = 5\vec{AB} = \begin{pmatrix}15\\-20\end{pmatrix}$

$OC = OA + AC$

$= \begin{pmatrix}7\\24\end{pmatrix} + \begin{pmatrix}15\\-20\end{pmatrix}$

$OC = \begin{pmatrix}22\\4\end{pmatrix}$

$y'' = (2x-5)^{-\frac{1}{2}}$

$\frac{dy}{dx} = \int (2x-5)^{-\frac{1}{2}}$

$= \frac{(2x-5)^{\frac{1}{2}}}{1} + c$

$(2(\frac{9}{2})-5)^{\frac{1}{2}} + c = 6$

$2 + c = 6$

$c = 4$

$\frac{dy}{dx} = (2x-5)^{\frac{1}{2}} + 4$

$y = \int (2x-5)^{\frac{1}{2}} + 4$

$= \frac{(2x-5)^{\frac{3}{2}}}{3} + 4x + c$

$= \frac{1}{3}(2x-5)^{\frac{3}{2}} + 4x + c$

$\frac{2}{3} = \frac{1}{3}(2(\frac{9}{2})-5)^{\frac{3}{2}} + 4(\frac{9}{2}) + c$

$\frac{2}{3} = 20\frac{2}{3} + c$

$c = -20$

$y = \frac{1}{3}(2x-5)^{\frac{3}{2}} + 4x - 20$ //

$(x) = (2x-1)(x+k) - 12$

$p(-k) = (2(-k)-1)(-k+k) - 12$

$= (-2k-1)(0)$

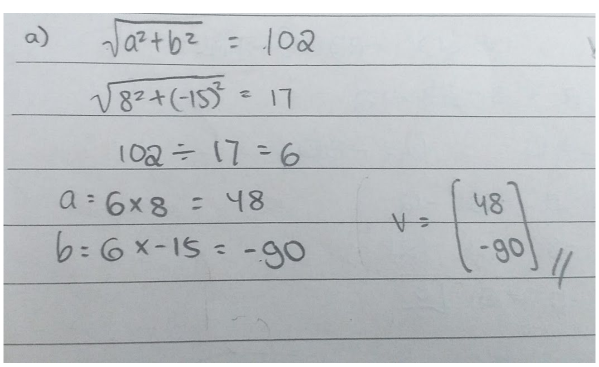
$p(-k) = -12$ //

$(x+3) \rightarrow x = -3$

Bri 5:

a) A vector v has a magnitude of 102 units and has the same direction as $\begin{pmatrix}8\\-15\end{pmatrix}$. Find v in the form $\begin{pmatrix}a\\b\end{pmatrix}$, where a and b are integers.

Cla 5:



a) $\sqrt{a^2+b^2} = 102$

$\sqrt{8^2+(-15)^2} = 17$

$102 \div 17 = 6$

$a = 6 \times 8 = 48$

$b = 6 \times -15 = -90$

$v = \begin{pmatrix}48\\-90\end{pmatrix}$ //

b) Vectors c $\begin{pmatrix}4\\3\end{pmatrix}$ = and d = $\begin{pmatrix}p-q\\5p+q\end{pmatrix}$ are such that c + 2d = $\begin{pmatrix}p^2\\27\end{pmatrix}$. Find the possible values of the constants p and q.

b) $c = \begin{bmatrix} 4 \\ 3 \end{bmatrix}$ $d = \begin{bmatrix} p-q \\ 5p+q \end{bmatrix}$ $c + 2d = \begin{bmatrix} p^2 \\ 27 \end{bmatrix}$

$$\begin{bmatrix} 4 \\ 3 \end{bmatrix} + 2\begin{bmatrix} p-q \\ 5p+q \end{bmatrix} = \begin{bmatrix} p^2 \\ 27 \end{bmatrix}$$

$$\begin{bmatrix} 4 \\ 3 \end{bmatrix} + \begin{bmatrix} 2p-2q \\ 10p+2q \end{bmatrix} = \begin{bmatrix} p^2 \\ 27 \end{bmatrix}$$

$4 + 2p - 2q = p^2$

$3 + 10p + 2q = 27$

$2q = 27 - 3 - 10p$

$2q = 24 - 10p$

$4 + 2p - (24 - 10p) = p^2$

$4 + 2p - 24 + 10p = p^2$

$12p - 20 = p^2$

$p^2 - 12p + 20 = 0$

$(p - 10)(p + 2) = 0$

$p = 10, -2$

$2q = 24 - 10(10)$

$2q = 24 - 100$

$2q = -76$

$q = -38$

$2q = 24 - 10(-2)$

$2q = 44$

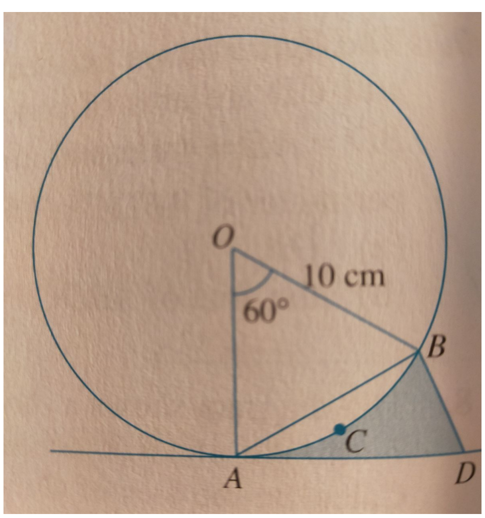
$q = 22$

$p = 10, -2$
$q = -38, 22$

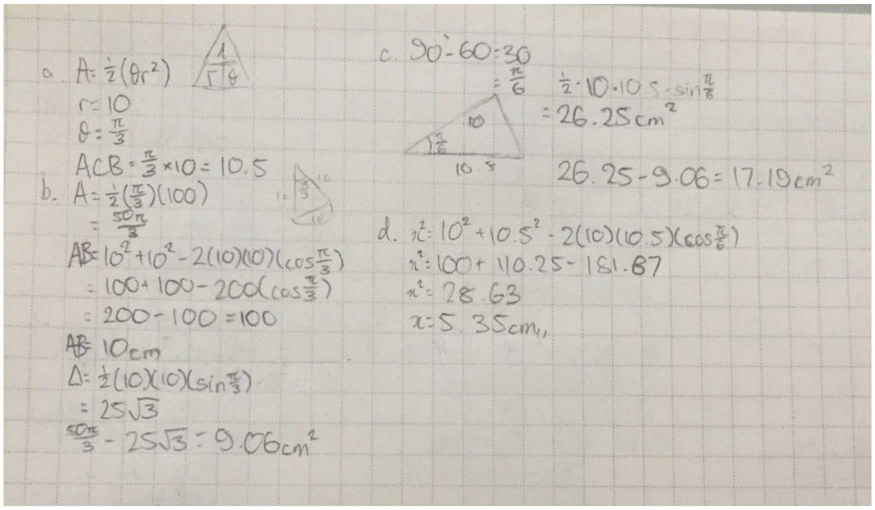
Sac 1

The diagram shows three points A, B, and C on a circle, centre O and radius 10 cm. The line AD is a tangent to the circle. Given that angle AOB = 60*, find, to one decimal place,

(a) The length of the arc ACB,
(b) The area of the segment ACB (Given that AD has the same length as arc ACB),
(c) The area of the shaded region ACBD,
(d) The length of BD.



Liz A1:


a. $A = \frac{1}{2}(\theta r^2)$

$r = 10$

$\theta = \frac{\pi}{3}$

$ACB = \frac{\pi}{3} \times 10 = 10.5$

b. $A = \frac{1}{2}(\frac{\pi}{3})(100)$

$= \frac{50\pi}{3}$

$AB = 10^2 + 10^2 - 2(10)(10)(\cos\frac{\pi}{3})$

$= 100 + 100 - 200(\cos\frac{\pi}{3})$

$= 200 - 100 = 100$

$AB = 10cm$

$\Delta = \frac{1}{2}(10)(10)(\sin\frac{\pi}{3})$

$= 25\sqrt{3}$

$\frac{50\pi}{3} - 25\sqrt{3} = 9.06cm^2$

c. $90 - 60 = 30$

$= \frac{\pi}{6}$

$\frac{1}{2} \cdot 10 \cdot 10.5 \cdot \sin\frac{\pi}{6}$

$= 26.25cm^2$

$26.25 - 9.06 = 17.19cm^2$

d. $x^2 = 10^2 + 10.5^2 - 2(10)(10.5)(\cos\frac{\pi}{6})$

$x^2 = 100 + 110.25 - 181.87$

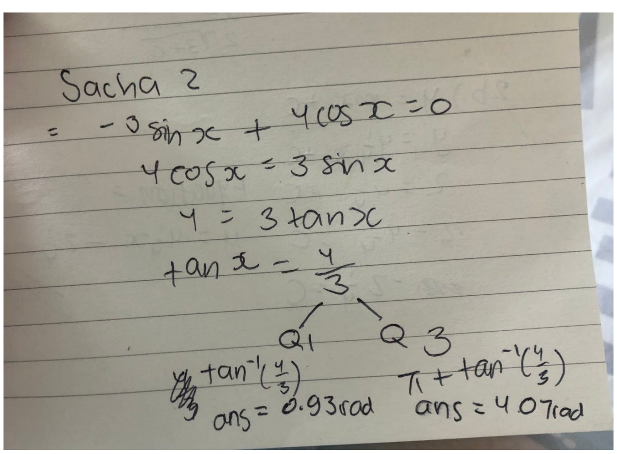
$x^2 = 28.63$

$x = 5.35cm$

Sac 2

The equation of a curve is y = 3 cos x + 4 sin x, where 0 ≤ x ≤ 2π. Calculate the values of x for which the tangents to the curve are parallel to the x-axis.

Tri a1:


Sacha 2

$= -3\sin x + 4\cos x = 0$

$4\cos x = 3\sin x$

$4 = 3\tan x$

$\tan x = \frac{4}{3}$

Q1 Q3

$\tan^{-1}(\frac{4}{3})$ ans = 0.93rad

$\pi + \tan^{-1}(\frac{4}{3})$ ans = 4.07rad

Sac 3

Show that $\frac{d}{dx}\left(\frac{1+\cos x}{\sin x}\right) = -\frac{1}{1-\cos x}$ and evaluate $\int_{\frac{\pi}{4}}^{\frac{\pi}{2}}\left(\frac{1}{1-\cos x}\right)dx$.

Mei a1

$$\frac{1+\cos x}{\sin x} \qquad u = 1+\cos x \quad v = \sin x$$
$$u' = -\sin x \quad v' = \cos x$$

$$\frac{-\sin x(\sin x) - (1+\cos x)(\cos x)}{(\sin x)^2}$$

$$= \frac{-\sin^2 x - \cos x - \cos^2 x}{\sin^2 x}$$

$$= \frac{-(\sin^2 x + \cos^2 x) - \cos x}{\sin^2 x}$$

$$= \frac{-1 - \cos x}{1 - \cos^2 x}$$

$$= \frac{-1 - \cos x}{(1+\cos x)(1-\cos x)}$$

$$= \frac{-1\,\cancel{(1+\cos x)}}{\cancel{(1+\cos x)}(1-\cos x)}$$

$$= \frac{-1}{1-\cos x} \qquad \text{shown!}$$

$$\int \frac{1}{1-\cos x} = \int \frac{-1}{1-\cos x} \times -1$$

$$= \frac{1+\cos x}{\sin x} \cdot -1$$

subs x $\frac{\pi}{2} - \frac{\pi}{4}$

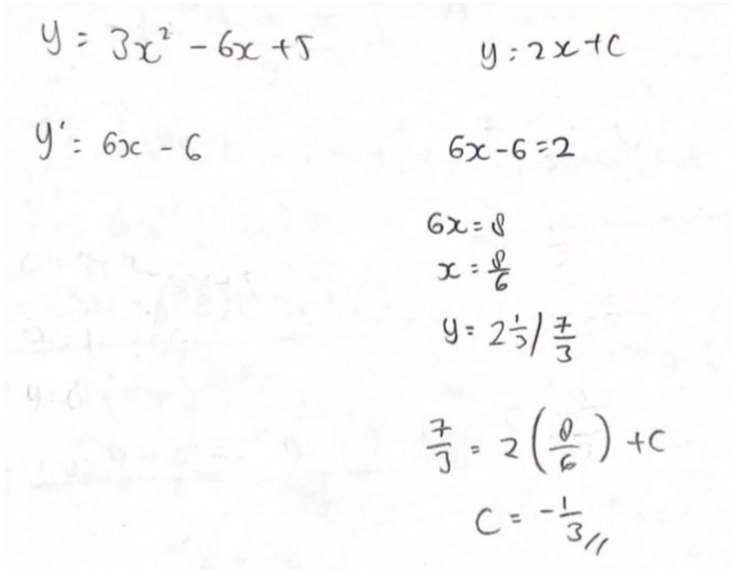
$$-1 - (-2.41)$$

$$= \underline{\underline{1.41}}$$

Sac 4

Find the value of *c* such that the straight line whose equation is y = 2x + c is tangential to the curve with equation y =3x^2-6x+5.

Ela 5:



$y = 3x^2 - 6x + 5$ $\quad$ $y = 2x + c$

$y' = 6x - 6$ $\quad$ $6x - 6 = 2$

$6x = 8$

$x = \frac{8}{6}$

$y = 2\frac{1}{3} / \frac{7}{3}$

$\frac{7}{3} = 2\left(\frac{8}{6}\right) + c$

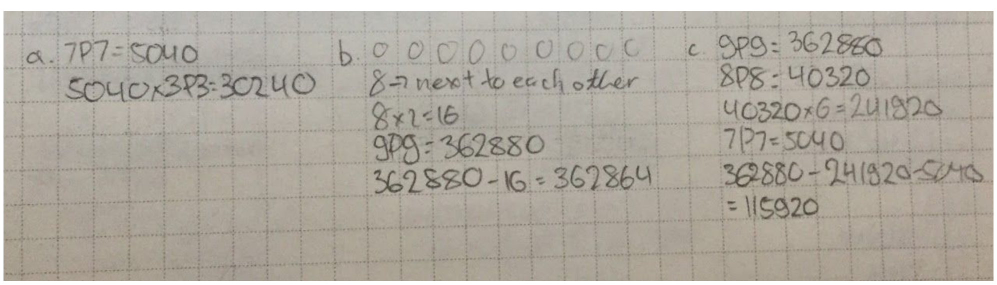
$c = -\frac{1}{3}$

Sac 5

9 different books are to be arranged on a book-shelf. 4 of these books were written by Shakespeare, 2 by Dickens and 3 by Conrad. How many possible permutations are there if,

(a) The books by Conrad must be next to each other,
(b) The books by Dickens are separated from each other,
(c) The books by Conrad are separated from each other.

Liz A3:



a. 7P7 = 5040
5040×3P3 = 30240

b. ○ ○ ○ ○ ○ ○ ○ ○ ○
8 → next to each other
8×2 = 16
9P9 = 362880
362880 − 16 = 362864

c. 9P9 = 362880
8P8 = 40320
40320×6 = 241920
7P7 = 5040
362880 − 241920 − 5040
= 115920

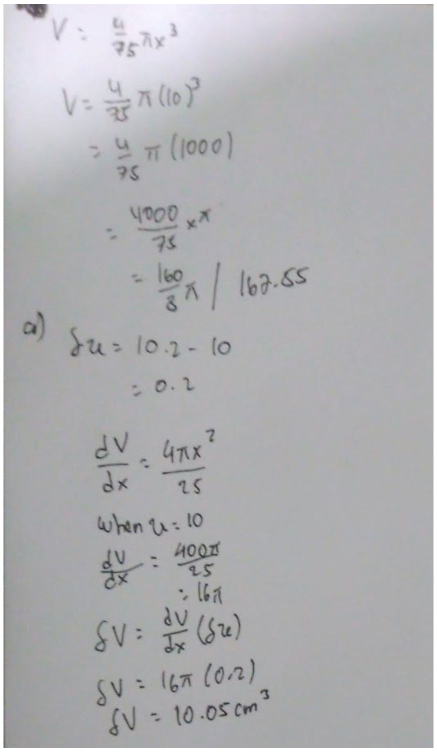
Mei 1

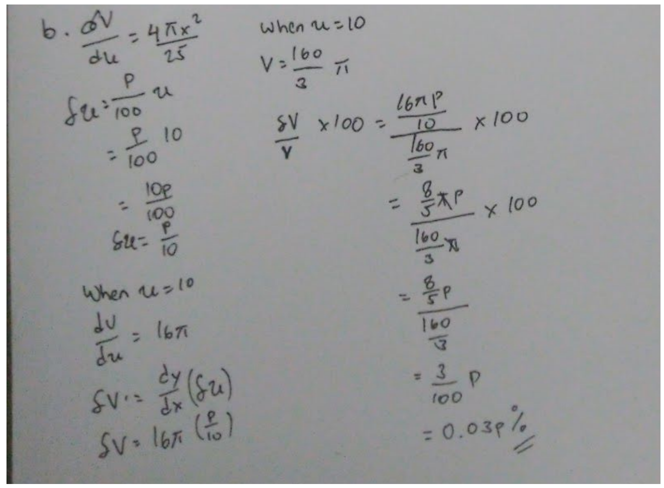
A vessel has the shape of an inverted cone. The radius of the top is 8 cm and the height is 20 cm. Water is poured into a height of x cm. Show that if the volume of the water is $V\ cm^3$, then $V = \frac{4}{75}\pi x^3$.

Write down $\frac{dV}{dx}$ and hence find

a) Approximate increase in V when x increases from 10 to 10.2 cm,
b) The approximate percentage change in V when x increases by $p\%$.

Tha a1:

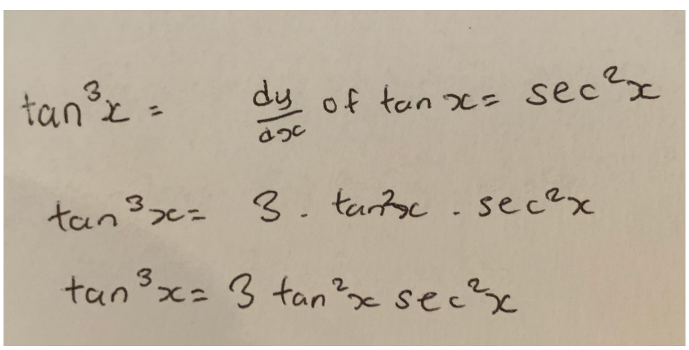




Mei 2

Show that $\frac{d}{dx}(tan^3 x) = 3\ tan^2 x\ sec^2 x$

Rai a2:

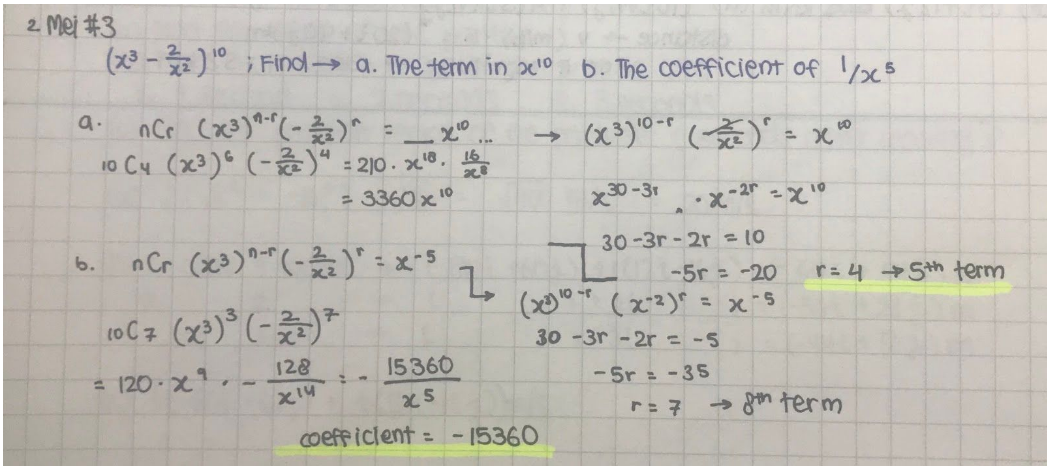


Mei 3

In the expansion of $(x^3 - \frac{2}{x^2})^{10}$, find

a) The term in x^{10}
b) The coefficient of $\frac{1}{x^5}$

Sep a2:



2 Mei #3

$(x^3 - \frac{2}{x^2})^{10}$; Find → a. The term in x^{10} b. The coefficient of $1/x^5$

a. $nCr\ (x^3)^{n-r}(-\frac{2}{x^2})^r = \_\ x^{10}...$ → $(x^3)^{10-r}(-\frac{2}{x^2})^r = x^{10}$

$10C4\ (x^3)^6(-\frac{2}{x^2})^4 = 210 \cdot x^{18} \cdot \frac{16}{x^8}$

$= 3360x^{10}$

$x^{30-3r} \cdot x^{-2r} = x^{10}$

$30 - 3r - 2r = 10$

$-5r = -20$ $r = 4$ → 5th term

b. $nCr\ (x^3)^{n-r}(-\frac{2}{x^2})^r = x^{-5}$

$(x^3)^{10-r}(x^{-2})^r = x^{-5}$

$10C7\ (x^3)^3(-\frac{2}{x^2})^7$

$30 - 3r - 2r = -5$

$= 120 \cdot x^9 \cdot -\frac{128}{x^{14}} = -\frac{15360}{x^5}$

$-5r = -35$

$r = 7$ → 8th term

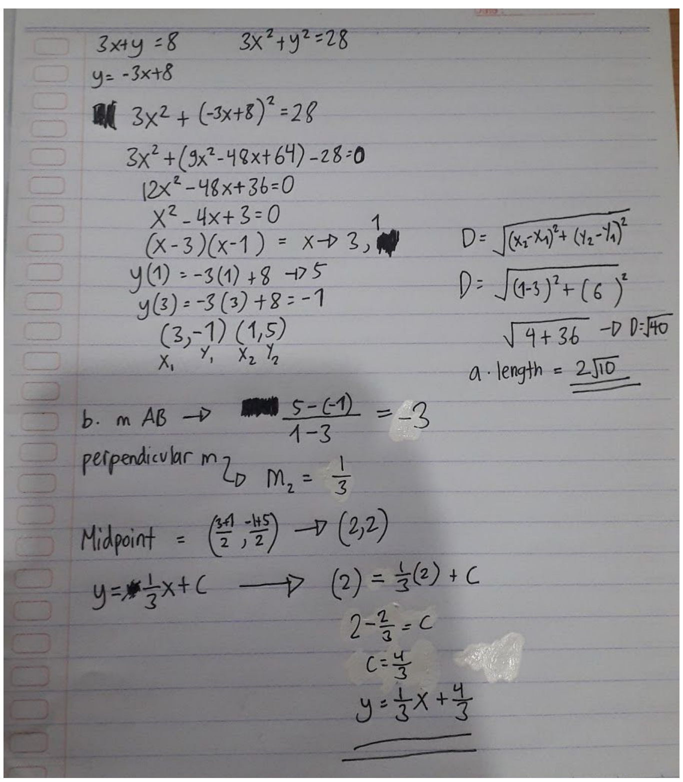
coefficient = -15360

Mei 4

The line $3x + y = 8$ intersects the curve $3x^2 + y^2 = 28$ at A and B. Calculate

a) The length of AB,
b) The equation of the perpendicular bisector of AB

Jas 5:



$3x+y=8$ $3x^2+y^2=28$

$y=-3x+8$

[redacted] $3x^2+(-3x+8)^2=28$

$3x^2+(9x^2-48x+64)-28=0$

$12x^2-48x+36=0$

$x^2-4x+3=0$

$(x-3)(x-1) = x \to 3, 1$ [redacted]

$y(1) = -3(1)+8 \to 5$

$y(3) = -3(3)+8 = -1$

$(3,-1)\ (1,5)$

$x_1\ y_1\ x_2\ y_2$

$D = \sqrt{(x_2-x_1)^2+(y_2-y_1)^2}$

$D = \sqrt{(1-3)^2+(6)^2}$

$\sqrt{4+36} \to D=\sqrt{40}$

a. length = $2\sqrt{10}$

b. m AB → [redacted] $\frac{5-(-1)}{1-3} = -3$

perpendicular m → $m_2 = \frac{1}{3}$

Midpoint = $(\frac{3+1}{2}, \frac{-1+5}{2}) \to (2,2)$

$y = $ [redacted] $\frac{1}{3}x + c \longrightarrow (2) = \frac{1}{3}(2) + c$

$2 - \frac{2}{3} = c$

$c = \frac{4}{3}$

$y = \frac{1}{3}x + \frac{4}{3}$

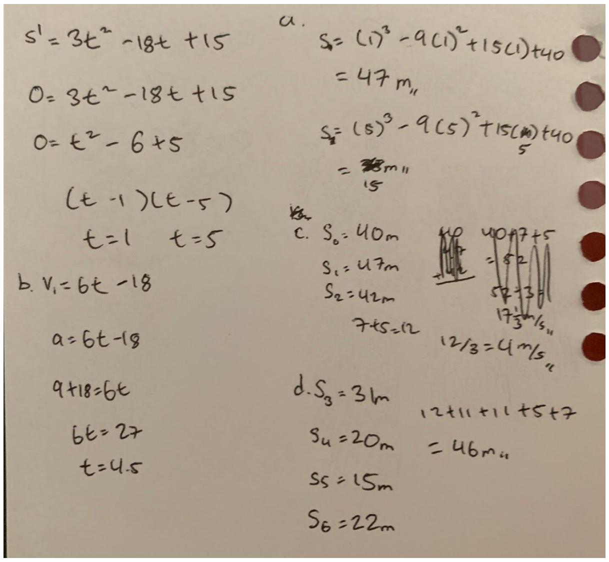
Mei 5

A particle travels in a straight line through a fixed point O. Its distance, s metres, from O is given $s = t^3 - 9t^2 + 15t + 40$ where t is the time in seconds after motion has begun. Calculate

a) The distances of P from O when its velocity is instantaneously zero,
b) The values of t when acceleration has a magnitude of 9m/s,

c) The average speed of P during first 2 seconds,
d) The total distance travelled in the first 6 seconds.

Rai a3:


$s' = 3t^2 - 18t + 15$

$0 = 3t^2 - 18t + 15$

$0 = t^2 - 6t + 5$

$(t-1)(t-5)$

$t = 1 \quad t = 5$

b. $v_1 = 6t - 18$

$a = 6t - 18$

$9 + 18 = 6t$

$6t = 27$

$t = 4.5$

a. $S = (1)^3 - 9(1)^2 + 15(1) + 40$

$= 47\,m$

$S = (5)^3 - 9(5)^2 + 15(5) + 40$

$= 15\,m$

c. $S_0 = 40m$

$S_1 = 47m$

$S_2 = 42m$

$7 + 5 = 12$

$12/3 = 4\,m/s$

d. $S_3 = 31m$

$S_4 = 20m$

$S_5 = 15m$

$S_6 = 22m$

$12 + 11 + 11 + 5 + 7$

$= 46m$

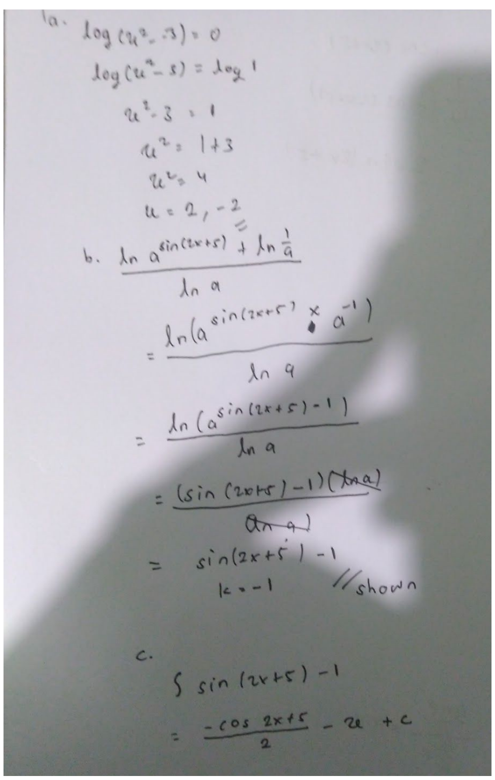
Liz 1

1a. Solve $lg(x^2 - 3) = 0$

1b. Show that, for $a > 0$, $\frac{ln\ a^{sin(2x+5)} + ln\ (\frac{1}{a})}{ln\ a}$ may be written as $sin(2x + 5) + k$, where k is an integer.

1c. Hence find $\int \frac{ln\ a^{sin(2x+5} + ln(\frac{1}{a})}{ln\ a}\ dx$

Tha a2:


1a. $\log(x^2 - 3) = 0$

$\log(x^2 - 3) = \log 1$

$x^2 - 3 = 1$

$x^2 = 1 + 3$

$x^2 = 4$

$x = 2, -2$

b. $\frac{\ln a^{\sin(2x+5)} + \ln \frac{1}{a}}{\ln a}$

$= \frac{\ln(a^{\sin(2x+5)} \times a^{-1})}{\ln a}$

$= \frac{\ln(a^{\sin(2x+5)-1})}{\ln a}$

$= \frac{(\sin(2x+5) - 1)(\ln a)}{\ln a}$

$= \sin(2x+5) - 1$ //shown

$k = -1$

c. $\int \sin(2x+5) - 1$

$= \frac{-\cos 2x+5}{2} - x + c$

Liz 2

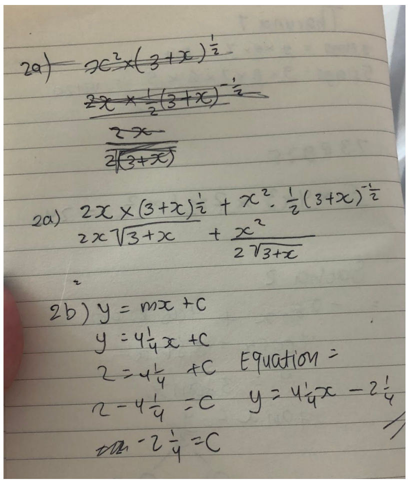
The equation of a curve is $y = x^2\sqrt{3+x}$ for $x \geq -3$.

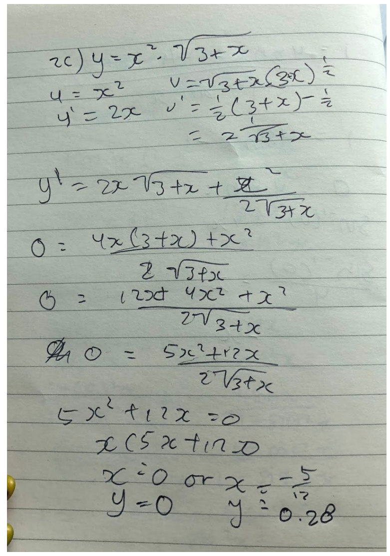
a) Find $\frac{dy}{dx}$.

b) Find the equation of the tangent to the curve $y = x^2\sqrt{3+x}$ at the point where $x = 1$.

c) Find the coordinates of the turning points of the curve $y = x^2\sqrt{3+x}$.

Tri a3:



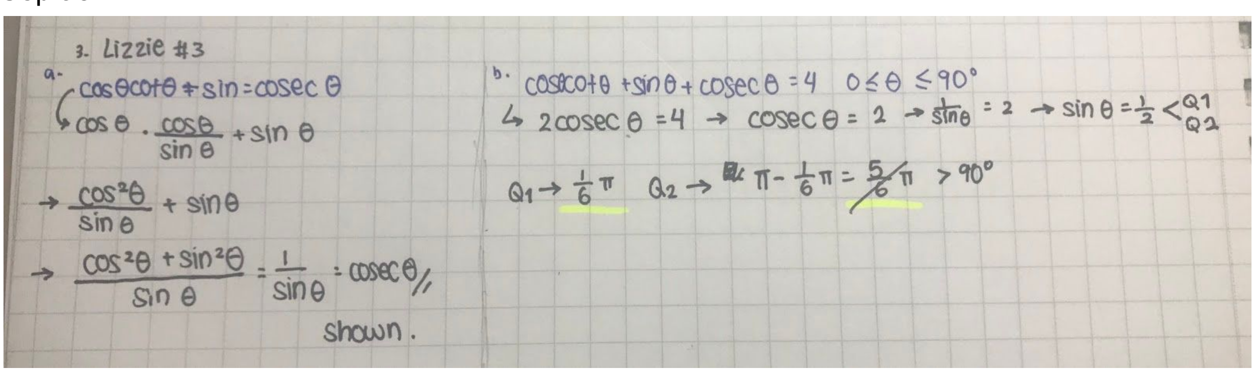


Liz 3

a. Show that $cos\theta cot\theta + sin = cosec\theta$

b. Hence solve $cos\theta cot\theta + sin\theta + cosec\theta = 4$ for $0° \leq \theta \leq 90°$

Sep a3:



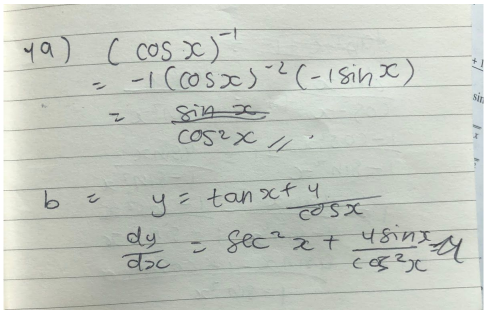
Liz 4

a. Differentiate $(cosx)^{-1}$ with respect to x.

b. Hence find $\frac{dy}{dx}$ given that $y = tanx + 4(cosx)^{-1}$.

c. Using your answer to part b, find the values of x in the range $0 \leq x \leq 2\pi$ such that $\frac{dy}{dx} = 4$.

Tri a4=



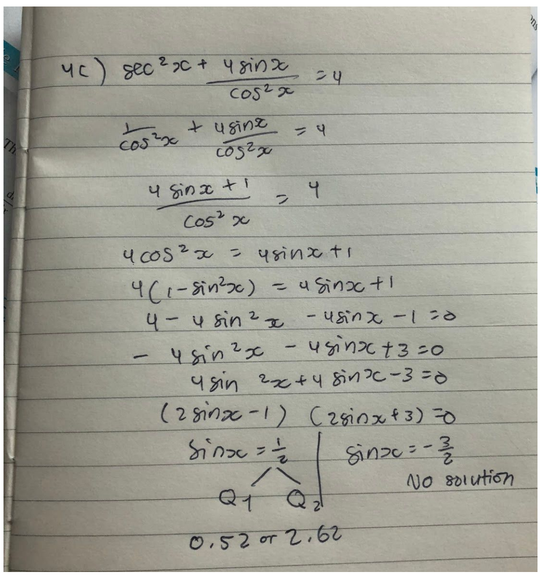
4a) $(\cos x)^{-1}$

$= -1(\cos x)^{-2}(-1\sin x)$

$= \frac{\sin x}{\cos^2 x}$ //

b = $y = \tan x + \frac{4}{\cos x}$

$\frac{dy}{dx} = \sec^2 x + \frac{4\sin x}{\cos^2 x} = 4$



4c) $\sec^2 x + \frac{4\sin x}{\cos^2 x} = 4$

$\frac{1}{\cos^2 x} + \frac{4\sin x}{\cos^2 x} = 4$

$\frac{4\sin x + 1}{\cos^2 x} = 4$

$4\cos^2 x = 4\sin x + 1$

$4(1-\sin^2 x) = 4\sin x + 1$

$4 - 4\sin^2 x - 4\sin x - 1 = 0$

$-4\sin^2 x - 4\sin x + 3 = 0$

$4\sin^2 x + 4\sin x - 3 = 0$

$(2\sin x - 1)(2\sin x + 3) = 0$

$\sin x = \frac{1}{2}$ | $\sin x = -\frac{3}{2}$ No solution

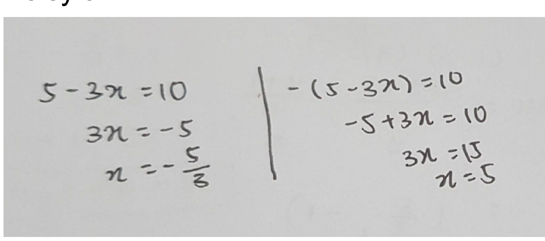
Q1 Q2

0.52 or 2.62

Liz 5

Solve the equation $|5 - 3x| = 10$.

meisy a4



$5 - 3x = 10$

$3x = -5$

$x = -\frac{5}{3}$

$-(5-3x) = 10$

$-5 + 3x = 10$

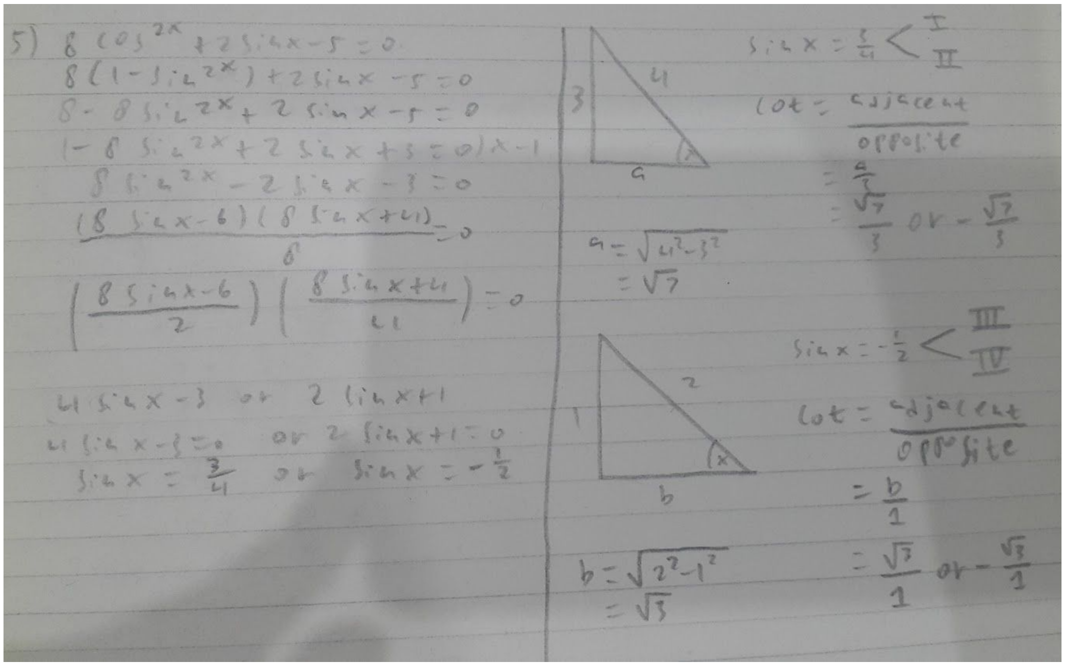
$3x = 15$

$x = 5$

Tri 1

If 8cos^2x + 2sinx - 5 = 0, show that sinx = ¾ and sinx= -1/2 . hence, find the possible exact values of cotx

Ama a5:



5) $8\cos^2 x + 2\sin x - 5 = 0$

$8(1 - \sin^2 x) + 2\sin x - 5 = 0$

$8 - 8\sin^2 x + 2\sin x - 5 = 0$

$(-8\sin^2 x + 2\sin x + 3 = 0) \times -1$

$8\sin^2 x - 2\sin x - 3 = 0$

$\frac{(8\sin x - 6)(8\sin x + 4)}{8} = 0$

$\left(\frac{8\sin x - 6}{2}\right)\left(\frac{8\sin x + 4}{4}\right) = 0$

$4\sin x - 3$ or $2\sin x + 1$

$4\sin x - 3 = 0$ or $2\sin x + 1 = 0$

$\sin x = \frac{3}{4}$ or $\sin x = -\frac{1}{2}$

$a = \sqrt{4^2 - 3^2}$
$= \sqrt{7}$

$\sin x = \frac{3}{4} <$ I, II

$\cot = \frac{\text{adjacent}}{\text{opposite}}$
$= \frac{a}{3}$
$= \frac{\sqrt{7}}{3}$ or $-\frac{\sqrt{7}}{3}$

$b = \sqrt{2^2 - 1^2}$
$= \sqrt{3}$

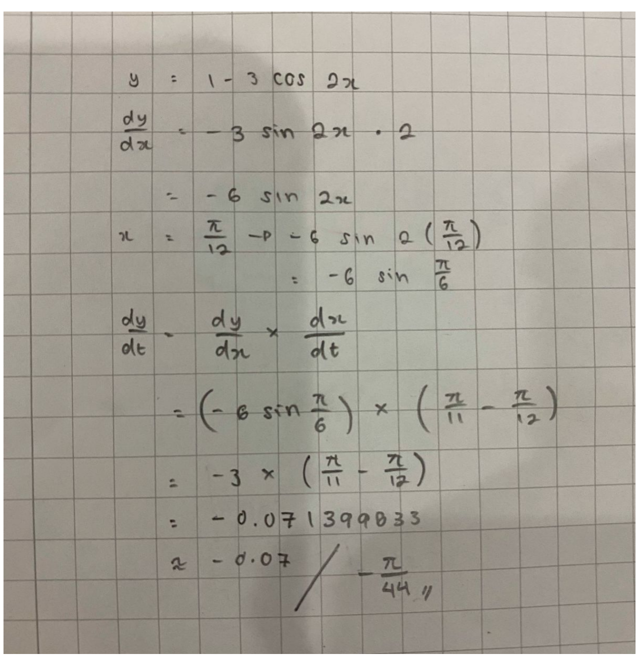
$\sin x = -\frac{1}{2} <$ III, IV

$\cot = \frac{\text{adjacent}}{\text{opposite}}$
$= \frac{b}{1}$
$= \frac{\sqrt{3}}{1}$ or $-\frac{\sqrt{3}}{1}$

Tri 2

Find the value of dy/dx for y= 1-3cos2x at the point where x= π/12. Obtain the approximate change in Y when x increases from π/12 to π/11.

Hel a1:



$y = 1 - 3\cos 2x$

$\frac{dy}{dx} = -3\sin 2x \cdot 2$

$= -6\sin 2x$

$x = \frac{\pi}{12} \rightarrow -6\sin 2\left(\frac{\pi}{12}\right)$

$= -6\sin\frac{\pi}{6}$

$\frac{dy}{dt} = \frac{dy}{dx} \times \frac{dx}{dt}$

$= \left(-6\sin\frac{\pi}{6}\right) \times \left(\frac{\pi}{11} - \frac{\pi}{12}\right)$

$= -3 \times \left(\frac{\pi}{11} - \frac{\pi}{12}\right)$

$= -0.071399833$

≈ -0.07 / $-\frac{\pi}{44}$ //

Tri 3

Integrate the following:

a) 1/4x^4
b) (4x^3 - 8x^5)
c) 3/2 (3x-5)^-½

Liz A2:

a. $\frac{1}{4}x^4$

$y' = x^3$

b. $(4x^3 - 8x^5)$

$y' = 12x^2 - 40x^4$

c. $\frac{3}{2}(3x-5)^{-\frac{1}{2}}$

$-\frac{3}{4}(3x-5)^{-\frac{3}{2}}(3)$

$-\frac{9}{4}(3x-5)^{-\frac{3}{2}}$,,

Tri 4

A particle P travels in a straight line so that its displacement, x m, from a fixed point O, t seconds after passing O, is given by x= 12t-t^3

a) The acceleration of the particle when it comes instantaneously at rest,
b) The velocity of the particle when it is next at O
c) The distance travelled by the particle during the first 3 seconds.

Sep a5

5. Tricia #4

displacement $x = 12t - t^3$ a. Acceleration (i@ rest) b. velocity (next @ O) c. Distance 3s.

a. $a = d''$ (i @rest → v = 0)

$d' = 12 - 3t^2 = 0 \rightarrow -3(t^2 - 4)$

$d'' = -6t = a$ ← $t = 2$

$a = -6(2) = -12\ m/s^2$

b. $d = 12t - t^3 = 0$

$-t\,(t^2 - 12)$

$t^2 = 12$ $t = \sqrt{12} = 2\sqrt{3}$?

$v = 12 - 3t^2$ ←

$= -24\ m/s$

c. 1s → 12 − 1 = 12

2s → 24 − 8 = 16

3s → 36 − 27 = 9

12m + 4m + 7m

= 23m

Tri 5

Convert the following to degrees:

a) π/8 b) 2π/3 c) 3π/4 d) 5π/6

Mei a5

a) $\frac{\pi}{8} \times \frac{180}{\pi} = 22.5°$

b) $\frac{2\pi}{3} \times \frac{180}{\pi}$ (60) $= 120°$

c) $\frac{3\pi}{4} \times \frac{180}{\pi}$ (45) $= 135°$

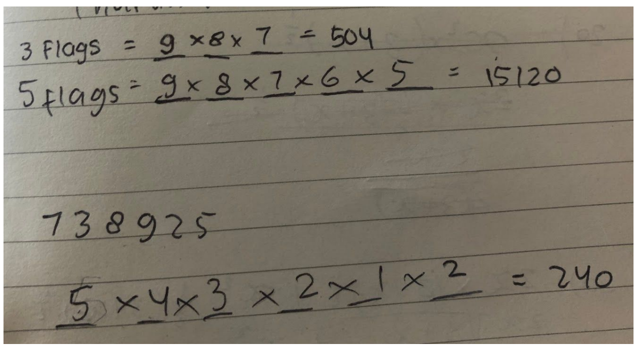
d) $\frac{5\pi}{6} \times \frac{180}{\pi}$ (30) $= 150°$

Tha 1:
(a) Jean has nine different flags.
(i) Find the number of different ways in which Jean can choose three flags from her nine flags.

(ii) Jean has five flagpoles in a row. She puts one of her nine flags on each flagpole. Calculate the number of different five-flag arrangements she can make.

(b) The six digits of the number 738925 are rearranged so that the resulting six-digit number is even. Find the number of different ways in which this can be done.

Tri a2:



Tha 2:
The position vectors of the points A and B relative to an origin O are −2i + 17j and 6i + 2j respectively.

(i) Find the vector AB.

(ii) Find the unit vector in the direction of AB.

(iii) The position vector of the point C relative to the origin O is such that OC = + OA mOB, where m is a constant. Given that C lies on the x-axis, find the vector OC.

Dyl 3:

a. 8i - 15j
b. (8i - 15j)/17 ???
c.

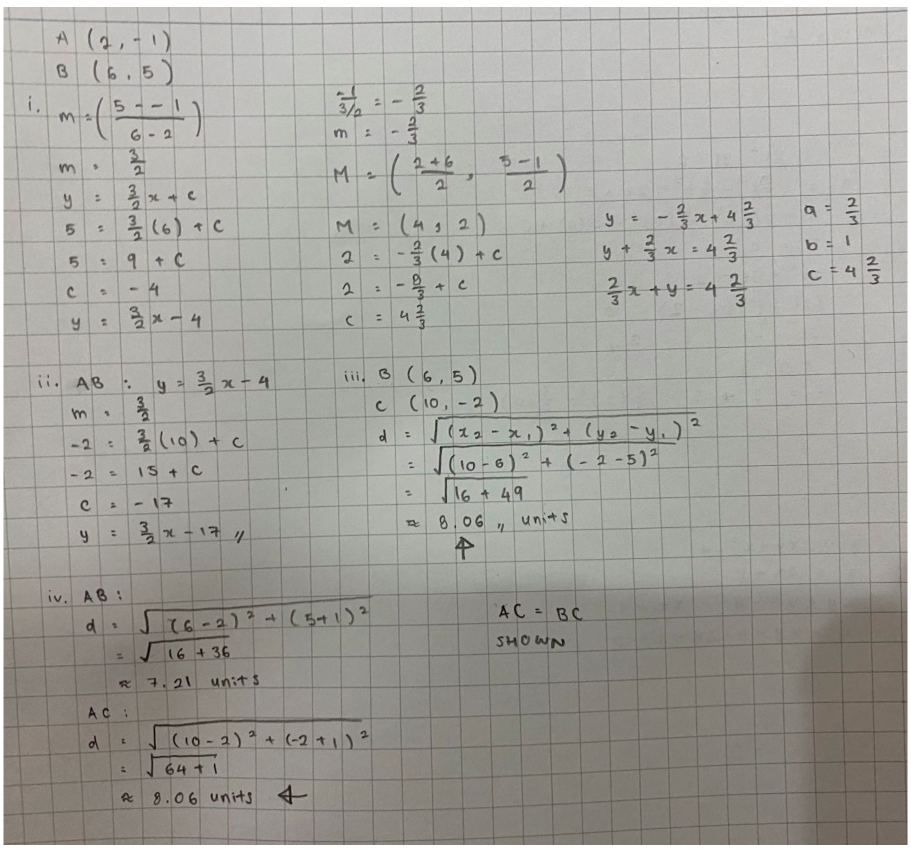
Tha 3:
The points A and B have coordinates (2, −1) and (6, 5) respectively.

(i) Find the equation of the perpendicular bisector of AB, giving your answer in the form ax+by=c, where a, b and c are integers.

The point C has coordinates (10, −2).

(ii) Find the equation of the line through C which is parallel to AB.
(iii) Calculate the length of BC.
(iv) Show that triangle ABC is isosceles.

Hel a2:



A (2, −1)
B (6, 5)

i. $m = \left(\frac{5 - -1}{6 - 2}\right)$

$m = \frac{3}{2}$

$y = \frac{3}{2}x + c$

$5 = \frac{3}{2}(6) + c$

$5 = 9 + c$

$c = -4$

$y = \frac{3}{2}x - 4$

$\frac{-1}{3/2} = -\frac{2}{3}$

$m = -\frac{2}{3}$

$M = \left(\frac{2+6}{2}, \frac{5-1}{2}\right)$

$M = (4, 2)$

$2 = -\frac{2}{3}(4) + c$

$2 = -\frac{8}{3} + c$

$c = 4\frac{2}{3}$

$y = -\frac{2}{3}x + 4\frac{2}{3}$

$y + \frac{2}{3}x = 4\frac{2}{3}$

$\frac{2}{3}x + y = 4\frac{2}{3}$

$a = \frac{2}{3}$

$b = 1$

$c = 4\frac{2}{3}$

ii. AB : $y = \frac{3}{2}x - 4$

$m = \frac{3}{2}$

$-2 = \frac{3}{2}(10) + c$

$-2 = 15 + c$

$c = -17$

$y = \frac{3}{2}x - 17$ //

iii. B (6, 5)

C (10, −2)

$d = \sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2}$

$= \sqrt{(10-6)^2 + (-2-5)^2}$

$= \sqrt{16 + 49}$

≈ 8.06 // units

iv. AB :

$d = \sqrt{(6-2)^2 + (5+1)^2}$

$= \sqrt{16 + 36}$

≈ 7.21 units

AC :

$d = \sqrt{(10-2)^2 + (-2+1)^2}$

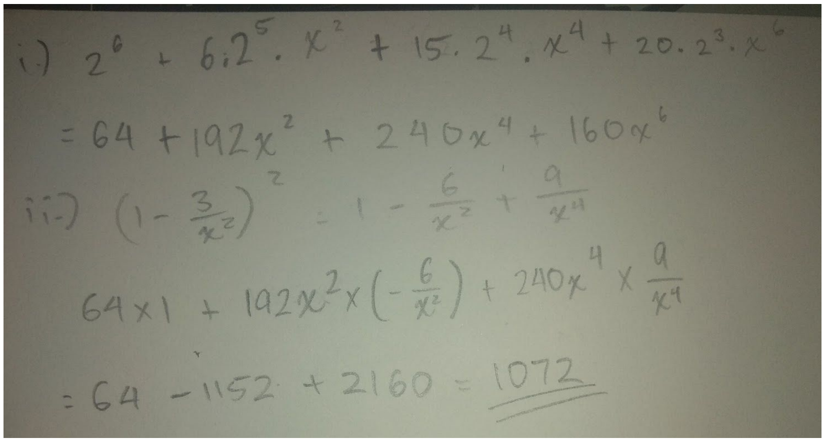
$= \sqrt{64 + 1}$

≈ 8.06 units

AC = BC
SHOWN

Tha 4:
(i) Find the first 4 terms in the expansion of $(2 + x^2)^6$ in ascending powers of x.
(ii) Find the term independent of x in the expansion of $(2 + x^2)^6(1 - \frac{3}{x^2})^2$.

Aid 5:



i) $2^6 + 6 . 2^5 . x^2 + 15 . 2^4 . x^4 + 20 . 2^3 . x^6$

$= 64 + 192x^2 + 240x^4 + 160x^6$

ii) $\left(1 - \frac{3}{x^2}\right)^2 = 1 - \frac{6}{x^2} + \frac{9}{x^4}$

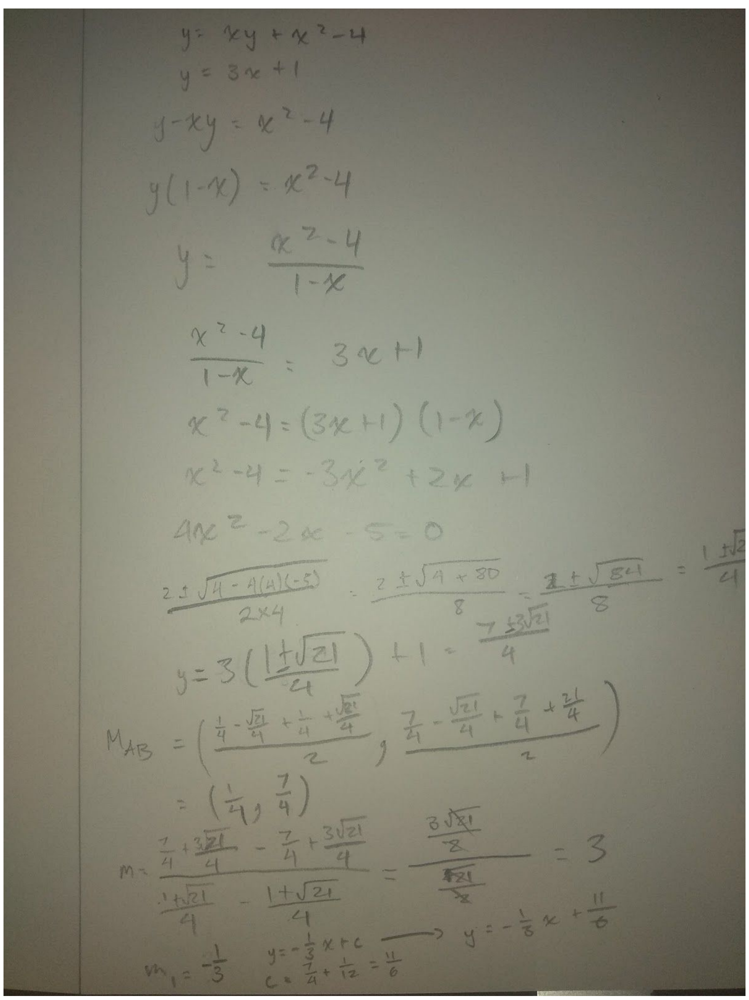
$64 \times 1 + 192x^2 \times \left(-\frac{6}{x^2}\right) + 240x^4 \times \frac{9}{x^4}$

$= 64 - 1152 + 2160 = \underline{1072}$

Tha 5:

The curve $y = xy + x^2 - 4$ intersects the line y=3x+1 at the points A and B. Find the equation of the perpendicular bisector of the line AB.

Aid 2:



$y = xy + x^2 - 4$

$y = 3x + 1$

$y - xy = x^2 - 4$

$y(1-x) = x^2 - 4$

$y = \frac{x^2 - 4}{1 - x}$

$\frac{x^2 - 4}{1 - x} = 3x + 1$

$x^2 - 4 = (3x+1)(1-x)$

$x^2 - 4 = -3x^2 + 2x + 1$

$4x^2 - 2x - 5 = 0$

$\frac{2 \pm \sqrt{4 - 4(4)(-5)}}{2 \times 4} = \frac{2 \pm \sqrt{4 + 80}}{8} = \frac{2 \pm \sqrt{84}}{8} = \frac{1 \pm \sqrt{21}}{4}$

$y = 3\left(\frac{1 \pm \sqrt{21}}{4}\right) + 1 = \frac{7 \pm 3\sqrt{21}}{4}$

$M_{AB} = \left(\frac{\frac{1}{4} - \frac{\sqrt{21}}{4} + \frac{1}{4} + \frac{\sqrt{21}}{4}}{2}, \frac{\frac{7}{4} - \frac{\sqrt{21}}{4} + \frac{7}{4} + \frac{21}{4}}{2}\right)$

$= \left(\frac{1}{4}, \frac{7}{4}\right)$

$m = \frac{\frac{7}{4} + \frac{3\sqrt{21}}{4} - \frac{7}{4} + \frac{3\sqrt{21}}{4}}{\frac{1+\sqrt{21}}{4} - \frac{1+\sqrt{21}}{4}} = \frac{\frac{3\sqrt{21}}{8}}{\frac{\sqrt{21}}{8}} = 3$

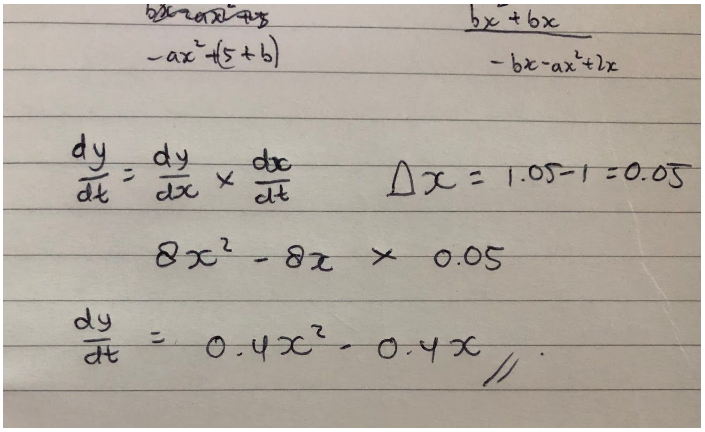
$m_1 = -\frac{1}{3}$ $\quad y = -\frac{1}{3}x + c$ $\longrightarrow$ $y = -\frac{1}{3}x + \frac{11}{6}$

$c = \frac{7}{4} + \frac{1}{12} = \frac{11}{6}$

Hel 1:

Given that $y = 2x^3 - 4x^2$, find the approximate change in y as x increases from 1 to 1.05, stating whether this is an increase or a decrease.

Tri a5:



$-ax^2 + (5 + b)$ $\quad$ $bx + bx$ / $-bx - ax^2 + 2x$

$\frac{dy}{dt} = \frac{dy}{dx} \times \frac{dx}{dt}$ $\quad$ $\Delta x = 1.05 - 1 = 0.05$

$8x^2 - 8x \times 0.05$

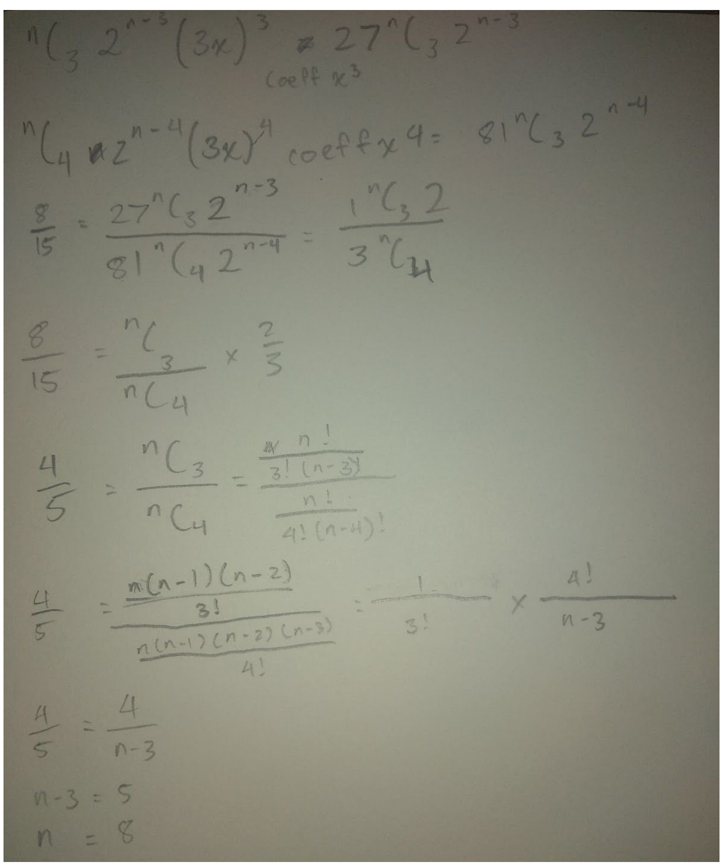
$\frac{dy}{dt} = 0.4x^2 - 0.4x$ //

Hel 2:

In the expansion of $(2+3x)^n$, the coefficients of x^3 and x^4 are in the ratio 8:15.

Find the value of n .

Aid 4:



${}^nC_3\, 2^{n-3} (3x)^3 = 27\,{}^nC_3\, 2^{n-3}$ coeff x^3

${}^nC_4\, 2^{n-4} (3x)^4$ coeff $x^4 = 81\,{}^nC_3\, 2^{n-4}$

$\frac{8}{15} = \frac{27\,{}^nC_3\, 2^{n-3}}{81\,{}^nC_4\, 2^{n-4}} = \frac{1\,{}^nC_3\, 2}{3\,{}^nC_4}$

$\frac{8}{15} = \frac{{}^nC_3}{{}^nC_4} \times \frac{2}{3}$

$\frac{4}{5} = \frac{{}^nC_3}{{}^nC_4} = \frac{\frac{n!}{3!(n-3)!}}{\frac{n!}{4!(n-4)!}}$

$\frac{4}{5} = \frac{\frac{n(n-1)(n-2)}{3!}}{\frac{n(n-1)(n-2)(n-3)}{4!}} = \frac{1}{3!} \times \frac{4!}{n-3}$

$\frac{4}{5} = \frac{4}{n-3}$

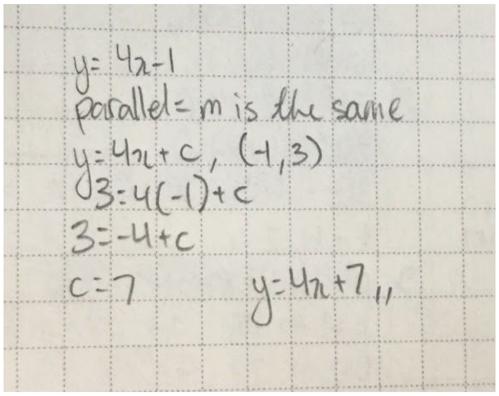
$n - 3 = 5$

$n = 8$

Hel 3:

Find the equation of the line that passes through the point (-1,3) and is parallel to the line $y = 4x - 1$.

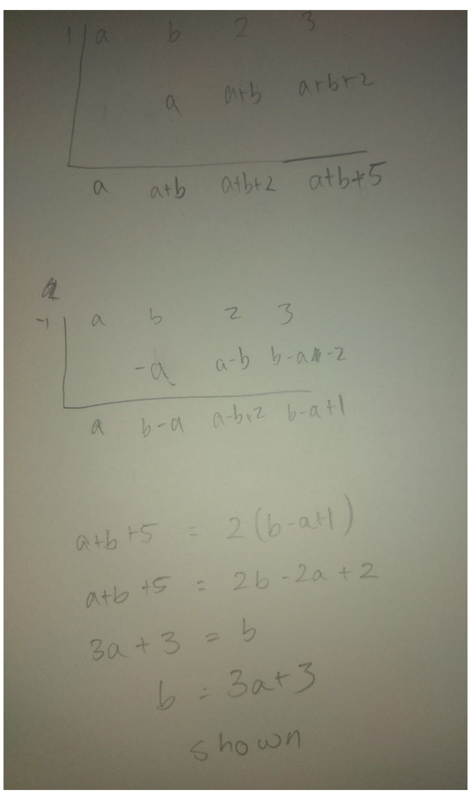
Liz A4:



Hel 4:

The remainder when $ax^3 + bx^2 + 2x + 3$ is divided by $x - 1$ is twice that when it is divided by $x + 1$. Show that $b = 3a + 3$.

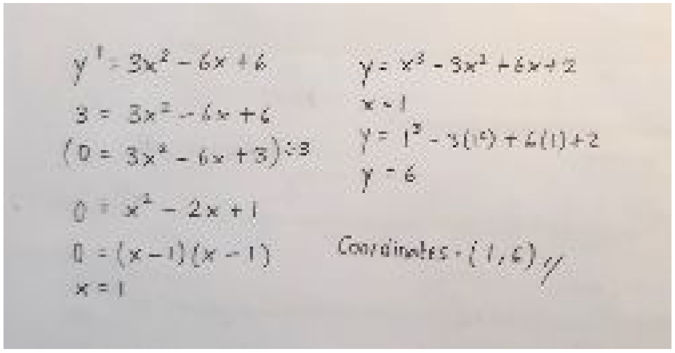
Aid 1:



Hel 5:

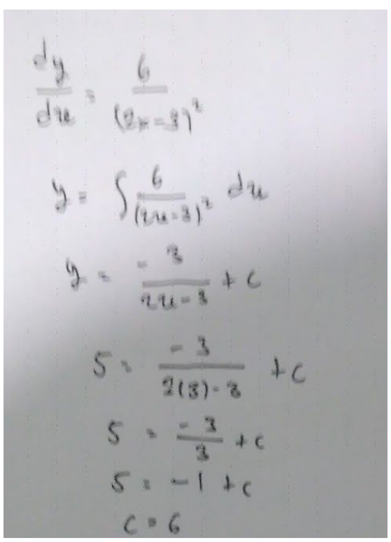
Find the coordinates of the point on the curve $y = x^3 - 3x^2 + 6x + 2$ at which the gradient is 3.

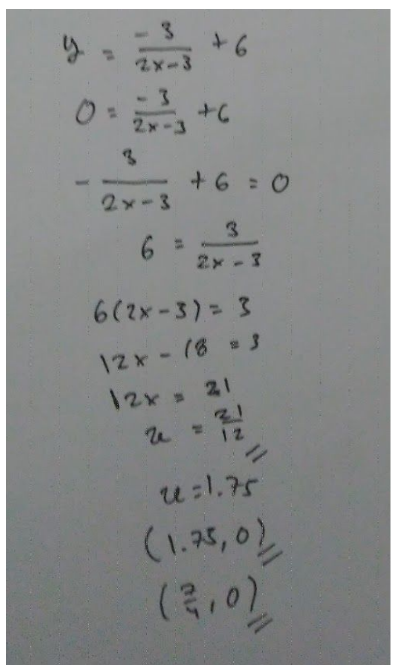
Gab #2



Aid 1: A curve is such that $\frac{dy}{dx} = \frac{6}{(2x-3)^2}$. Given that the curve passes through the point (3, 5), find the coordinates of the point where the curve crosses the x-axis.

Tha a3:

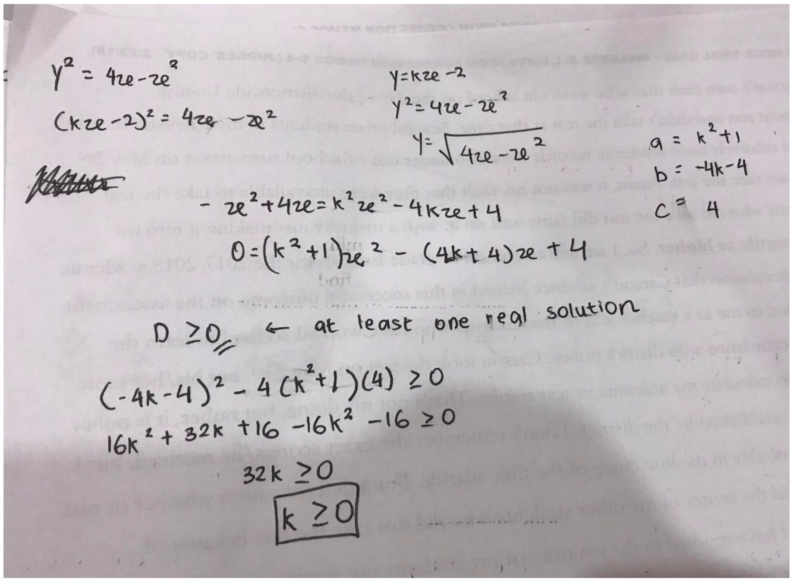




Aid 2:

Find the values of k for which the line y=kx-2 meets the curve $y^2 = 4x - x^2$.

Nat a6:

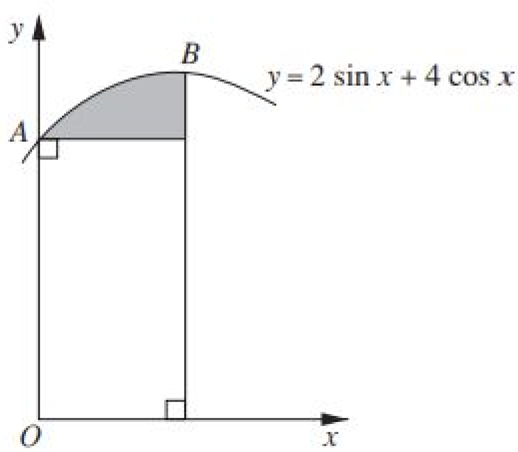


Aid 3:

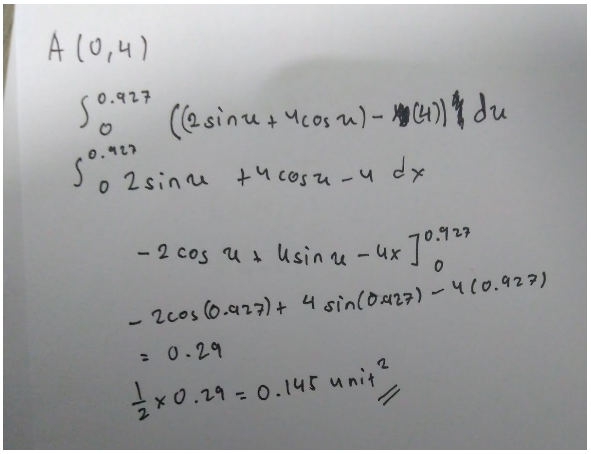
An ocean liner is travelling at 36 km h^{-1} on a bearing of 090°. At 0600 hours the liner, which is 90 km from a lifeboat and on a bearing of 315° from the lifeboat, sends a message for assistance. The lifeboat sets off immediately and travels in a straight line at constant speed, intercepting the liner at 0730 hours. Find the speed at which the lifeboat travels

Aid 4:

The diagram shows part of the curve y=2 sin x + 4 cos x, intersecting the y-axis at A and with maximum point B. A line is drawn from A parallel to the x-axis and a line is drawn from B parallel to the y-axis. Find the area of the shaded region.



Tha a4:



$A(0,4)$

$\int_0^{0.927} ((2\sin x + 4\cos x) - (4))\,dx$

$\int_0^{0.927} 2\sin x + 4\cos x - 4\,dx$

$-2\cos x + 4\sin x - 4x\Big]_0^{0.927}$

$-2\cos(0.927) + 4\sin(0.927) - 4(0.927)$

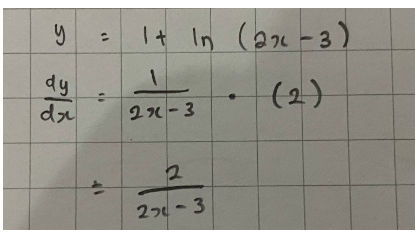
$= 0.29$

$\frac{1}{2} \times 0.29 = 0.145 \text{ unit}^2$ //

Aid 5:

Given that $y = 1 + ln(2x - 3)$, obtain an expression for $\frac{dy}{dx}$

Hel a3:



$y = 1 + \ln(2x - 3)$

$\frac{dy}{dx} = \frac{1}{2x-3} \cdot (2)$

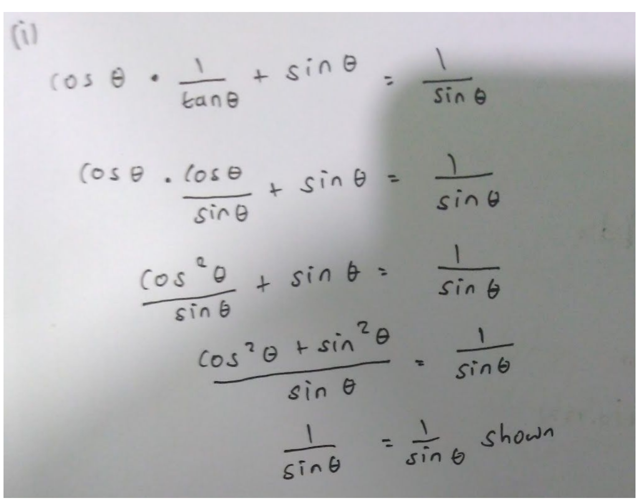
$= \frac{2}{2x-3}$

Dyl 1:

i) Show that cosθcotθ+sinθ = cosec θ.

ii) Hence, solve cosθcotθ+sinθ = 4 for 0° ≤ θ ≤ 360°

Tha a5:



(i)

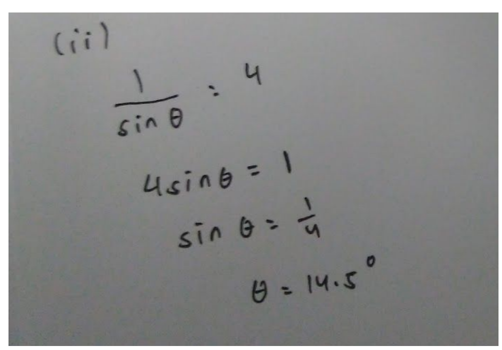
$\cos\theta \cdot \frac{1}{\tan\theta} + \sin\theta = \frac{1}{\sin\theta}$

$\cos\theta \cdot \frac{\cos\theta}{\sin\theta} + \sin\theta = \frac{1}{\sin\theta}$

$\frac{\cos^2\theta}{\sin\theta} + \sin\theta = \frac{1}{\sin\theta}$

$\frac{\cos^2\theta + \sin^2\theta}{\sin\theta} = \frac{1}{\sin\theta}$

$\frac{1}{\sin\theta} = \frac{1}{\sin\theta}$ shown



(ii)

$\frac{1}{\sin\theta} = 4$

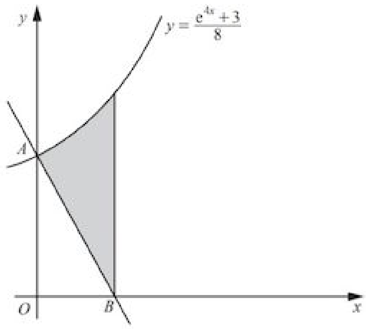
$4\sin\theta = 1$

$\sin\theta = \frac{1}{4}$

$\theta = 14.5^\circ$

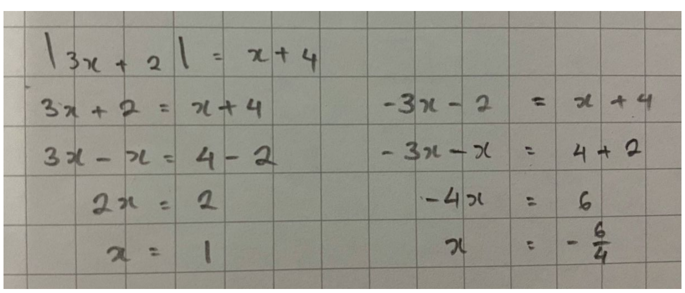
Dyl 2:

The diagram shows the graph of the curve (e^4x + 3)/8. The curve meets the y-axis at the point A. The normal to the curve A meets the x-axis at the point B. Find the area of the shaded region enclosed by the curve, the line AB and the line through B parallel to the y-axis. Give your answer in the form of e/a, where a is a constant. You must show all your working.



Dyl 3:
Solve |3x + 2| = x + 4.

Hel a4:



$|3x + 2| = x + 4$

$3x + 2 = x + 4$ $\quad$ $-3x - 2 = x + 4$

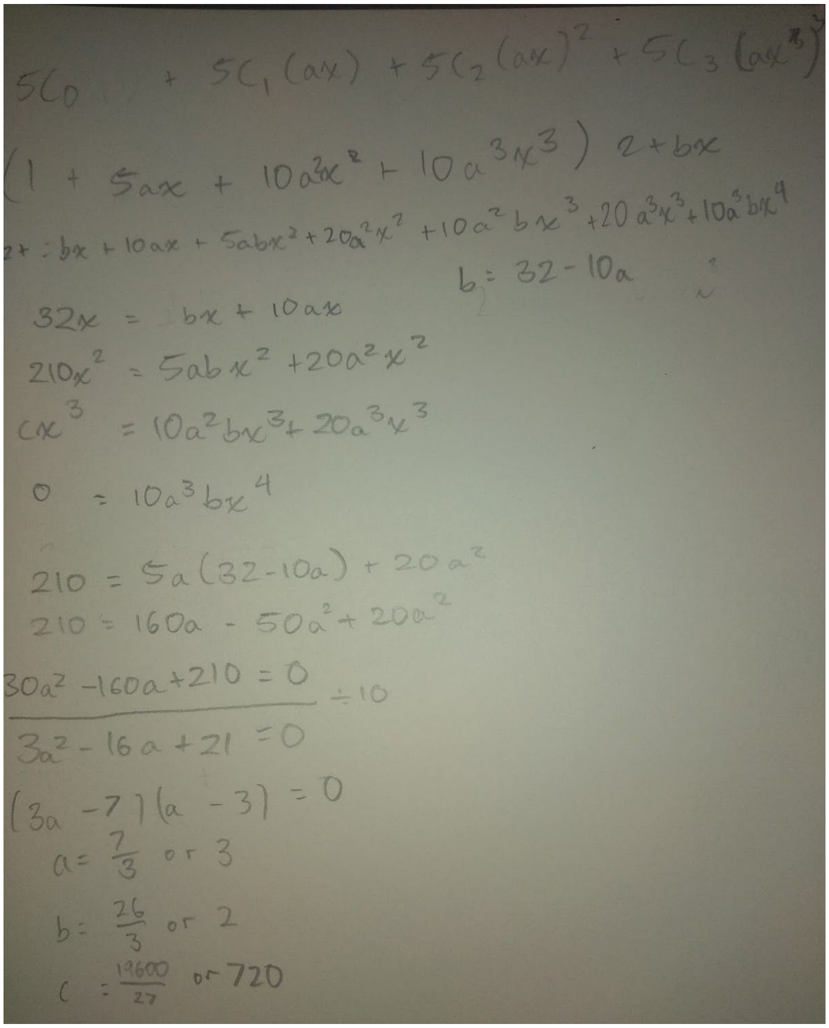
$3x - x = 4 - 2$ $\quad$ $-3x - x = 4 + 2$

$2x = 2$ $\quad$ $-4x = 6$

$x = 1$ $\quad$ $x = -\frac{6}{4}$

Dyl 4:
The first four terms in the expansion of (1+ax)^5(2+bx) are 2 + 32x + 210x^2 + cx^3 where a, b and c are integers. Show that 3a^2 - 16a + 21 = 0 and hence find the values of a, b and c.

Aid 3:



$5C_0 + 5C_1(ax) + 5C_2(ax)^2 + 5C_3(ax^3)^3$

$(1 + 5ax + 10a^2x^2 + 10a^3x^3)(2 + bx)$

$2 + bx + 10ax + 5abx^2 + 20a^2x^2 + 10a^2bx^3 + 20a^3x^3 + 10a^3bx^4$

$b = 32 - 10a$

$32x = bx + 10ax$

$210x^2 = 5abx^2 + 20a^2x^2$

$cx^3 = 10a^2bx^3 + 20a^3x^3$

$0 = 10a^3bx^4$

$210 = 5a(32 - 10a) + 20a^2$

$210 = 160a - 50a^2 + 20a^2$

$30a^2 - 160a + 210 = 0 \quad \div 10$

$3a^2 - 16a + 21 = 0$

$(3a - 7)(a - 3) = 0$

$a = \frac{7}{3}$ or 3

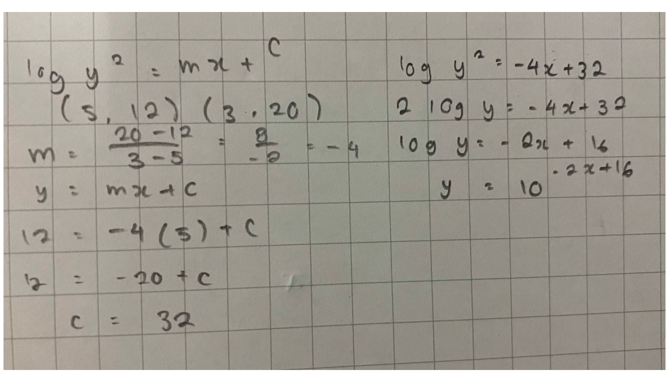
$b = \frac{26}{3}$ or 2

$c = \frac{19600}{27}$ or 720

Dyl 5:

When $lg\, y^2$ is plotted against x, a straight line is obtained passing through the points (5, 12) and (3, 20). Find y in terms of x, giving your answer in the form $y = 10^{ax+b}$, where a and b are integers.

Hel a5:



$\log y^2 = mx + c$

$(5, 12)\ (3, 20)$

$m = \frac{20 - 12}{3 - 5} = \frac{8}{-2} = -4$

$y = mx + c$

$12 = -4(5) + c$

$12 = -20 + c$

$c = 32$

$\log y^2 = -4x + 32$

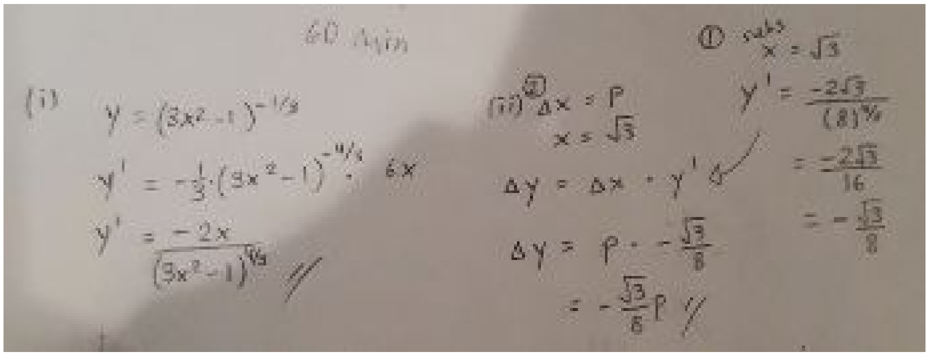
$2 \log y = -4x + 32$

$\log y = -2x + 16$

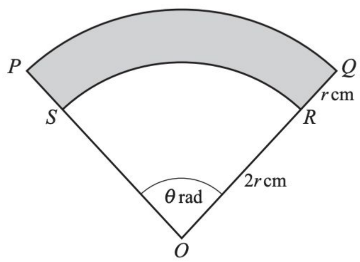
$y = 10^{-2x+16}$

Cho 1:
(i) Differentiate $y = (3x^2 - 1)^{-1/3}$ with respect to x.

(ii) Find the approximate change in y as x increases from $\sqrt{3}$ to $sqrt\,3 + p$, where p is small.
Gab #3

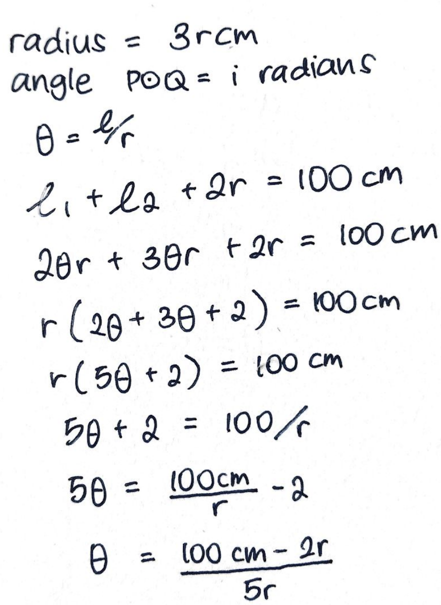


Cho 2:



The diagram shows a sector OPQ of the circle centre O, radius 3rcm. The points S and R lie on OP and OQ respectively such that ORS is a sector of the circle centre O, radius 2r cm. The angle POQ = i radians. The perimeter of the shaded region PQRS is 100 cm.
Question: Find i in terms of r.

Ric ANS 1:



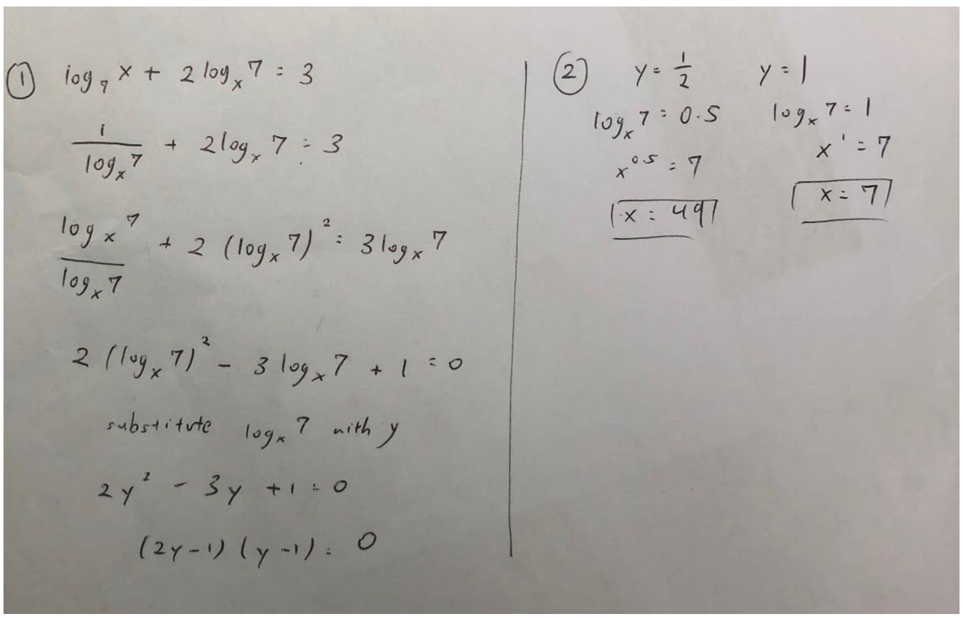
Cho 3:
write down the period of $2cos3x - 1$

Ehr 3: $360° \div 3 = 120°$

Cho 4:

Solve $\log_7 x + 2\log_x 7 = 3.$

Cha 4:



① $\log_7 x + 2\log_x 7 = 3$

$\frac{1}{\log_x 7} + 2\log_x 7 = 3$

$\frac{\log_x x^7}{\log_x 7} + 2(\log_x 7)^2 = 3\log_x 7$

$2(\log_x 7)^2 - 3\log_x 7 + 1 = 0$

substitute $\log_x 7$ with y

$2y^2 - 3y + 1 = 0$

$(2y-1)(y-1) = 0$

② $y = \frac{1}{2}$ $y = 1$

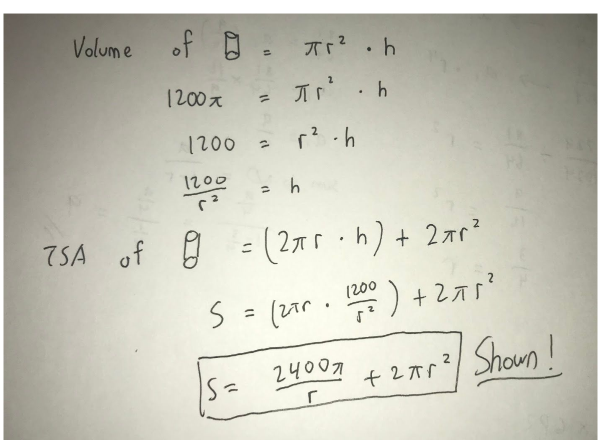
$\log_x 7 = 0.5$ $\log_x 7 = 1$

$x^{0.5} = 7$ $x^1 = 7$

$x = 49$ $x = 7$

Cho 5:
A solid circular cylinder has a base radius of r cm and a height of h cm. The cylinder has a volume of 1200π cm^3 and a total surface area of S cm^2. Show that $S = 2r^2 + 2400/r$

Nev 5:



Volume of cylinder $= \pi r^2 \cdot h$

$1200\pi = \pi r^2 \cdot h$

$1200 = r^2 \cdot h$

$\frac{1200}{r^2} = h$

TSA of cylinder $= (2\pi r \cdot h) + 2\pi r^2$

$S = (2\pi r \cdot \frac{1200}{r^2}) + 2\pi r^2$

$S = \frac{2400\pi}{r} + 2\pi r^2$ Shown!

Ehr 1:
A helicopter flies from a point P with position vector (50i + 100j) km to a point Q. The helicopter flies with a constant velocity of (30i-40j) km/h and takes 2.5 hours to complete the journey. Find the position vector of the point Q.

Cho 1:

$\bar{r} = \bar{a} + \bar{v} \cdot t$

$\bar{r} = (50i + 100j) + (30i - 40j)2.5$

$\bar{r} = 50i + 100j + 75i - 100j$

$\bar{r} = 125i$

Ehr 2:
A particle moves in a straight line, so that, *t* seconds after leaving fixed point O, its velocity, v m/s is given by: $v = pt^2 + qt + 4$
Where p and q are constants. When *t*=1 the acceleration of the particle is 8 m/s. WHen *t*=2, the displacement of the particle from O is 22m. Find the value of p and q.

Ric ANS 2:

displacement
↓
velocity
↓
acceleration

$v = pt^2 + qt + 4$

$a = 2pt + q$

$2p + q = 8$

$d = \int pt^2 + qt + 4$

$= \frac{1}{3}pt^3 + \frac{1}{2}qt^2 + 4t$

$\frac{1}{3}p(2)^3 + \frac{1}{2}q(2)^2 + 4(2) = 22$

$\frac{8}{3}p + 2q + 8 = 22$

$\frac{8}{3}p + 2q = 14$

$8p + 6q = 42$

$q = 8 - 2p$

$8p + 6(8 - 2p) = 42$

$8p + 48 - 12p = 42$

$-4p = 42 - 48 = -6$

$4p = 6$

$p = \frac{6}{4} = \frac{3}{2}$

$q = 5$

Ehr 3:
Find the area enclosed by the curve $y = x^2 - 4$ and the x axis
Bel ans #3

$y = x^2 - 4$

$x^2 - 4 = 0$

$x^2 = 4$

$x = \pm 2$

$\int_{-2}^{2} 0 - (x^2 - 4)$

$= \int_{-2}^{2} -x^2 + 4$

$= -\frac{1}{3}x^3 + 4x$

→ (sub $x = 2$) − (sub $x = -2$)

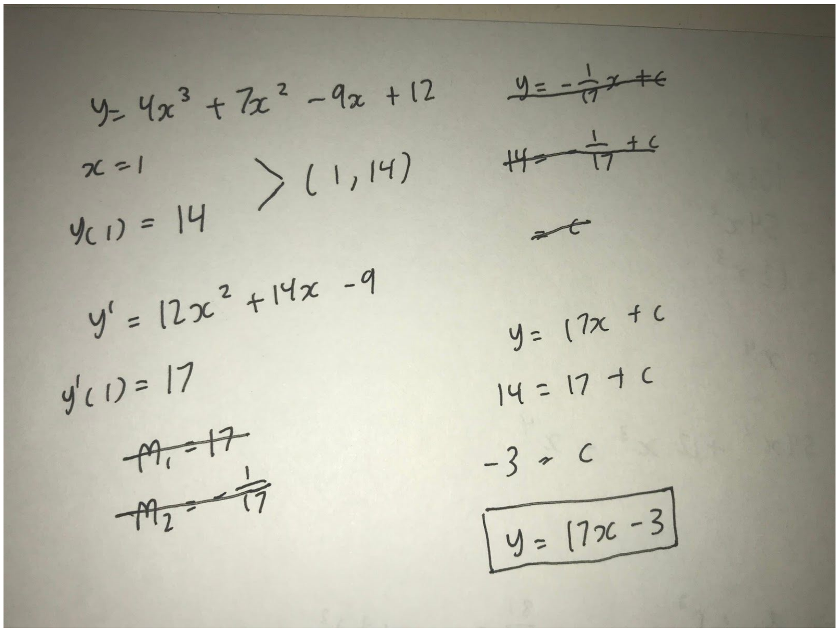
$= \frac{16}{3} - -\frac{16}{3}$

$= \frac{32}{3}$ units²

Ehr 4:

Find the equation of the line tangent to the curve $y = 4x^3 + 7x^2 - 9x + 12$ when x=1

Nev 4:



Ehr 5:

Derive the equation y=(2x+1)(x+2)

Cha 5:

u’v + v’u = 2(x+2) + 1(2x+1) = 4x + 5

Cha 1:

Given that $7^x \times 49^y = 1$ and $5^{5x} \times 125^{\frac{2y}{3}} = \frac{1}{25}$, calculate the value of x and y.

Nat a7:

$7^{x} \times 7^{2y} = 1 \leftarrow 7^{0}$

$x + 2y = 0$

$x = -2y$

$x = -2\left(\frac{1}{4}\right)$

$x = -\frac{1}{2}$

$5^{5x} \times 5^{3\left(\frac{2y}{3}\right)} = 5^{-2}$

$5x + 2y = -2$

$5(-2y) + 2y = -2$

$-10y + 2y = -2$

$-8y = -2$

$y = \frac{1}{4}$

Cha 2:

Derive $y = (1 + e^{x^2})(x + 5)$

Cho 2:

$y = (1 + e^{x^2})(x+5)$

$u = 1 + e^{x^2}$ $\quad v = x + 5$

$u' = 2xe^{x^2}$ $\quad v' = 1$

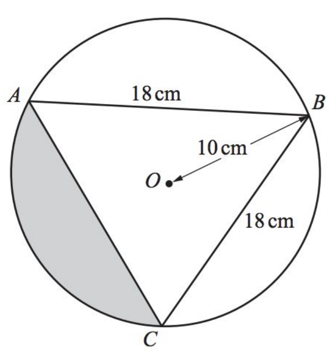
$y' = u'v + v'u$

$(2xe^{x^2})(x+5) + (1 + ex^2)$

$2x^2 e^{x^2} + 10xex^2 + 1 + ex^2$

$2x^2 + 10x + 1) ex^2 + 1$

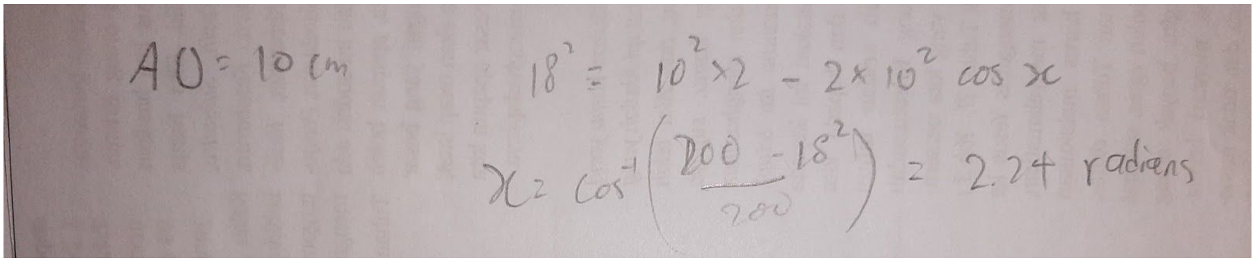
Cha 3:



The diagram shows a circle centre O, radius 10 cm. The points A, B and C lie on the circumference of the circle such that AB = BC = 18cm.

Show that angle AOB = 2.24 radians correct to 2 decimal places.

Ehr 3:



AO = 10 cm

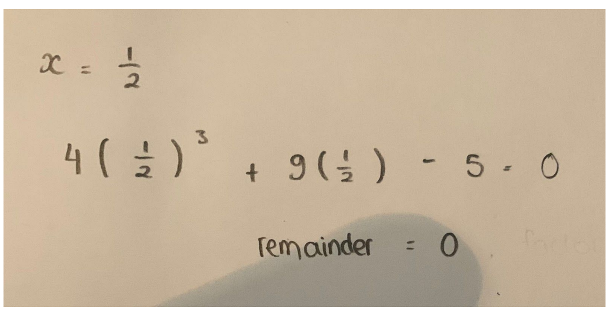
$18^2 = 10^2 \times 2 - 2 \times 10^2 \cos x$

$x = \cos^{-1}\left(\frac{200 - 18^2}{200}\right) = 2.24$ radians

Cha 4:

Use the factor theorem to show that 2x - 1 is a factor of p(x), where p(x) = $4x^3 + 9x - 5$

Bel ans #2



$x = \frac{1}{2}$

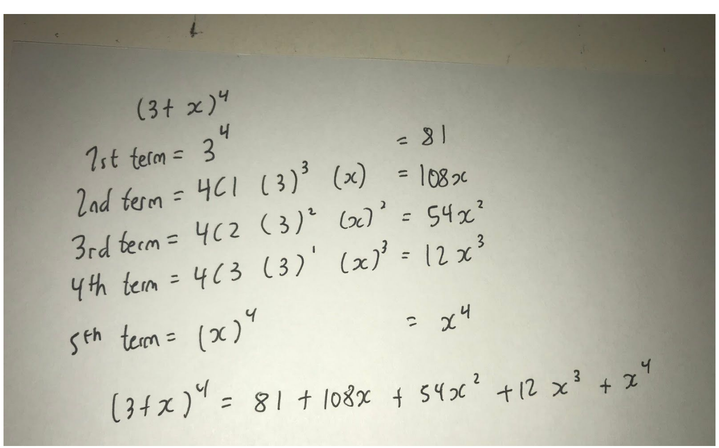
$4\left(\frac{1}{2}\right)^3 + 9\left(\frac{1}{2}\right) - 5 = 0$

remainder = 0

Cha 5:

Expand $(3 + x)^4$ evaluating each coefficient

Nev #5



$(3 + x)^4$

1st term = 3^4 $= 81$

2nd term = $4C1\ (3)^3\ (x)$ $= 108x$

3rd term = $4C2\ (3)^2\ (x)^2$ $= 54x^2$

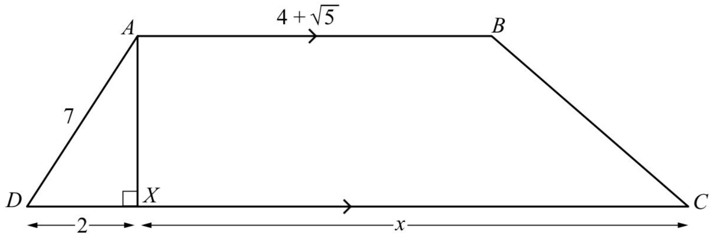
4th term = $4C3\ (3)^1\ (x)^3$ $= 12x^3$

5th term = $(x)^4$ $= x^4$

$(3 + x)^4 = 81 + 108x + 54x^2 + 12x^3 + x^4$

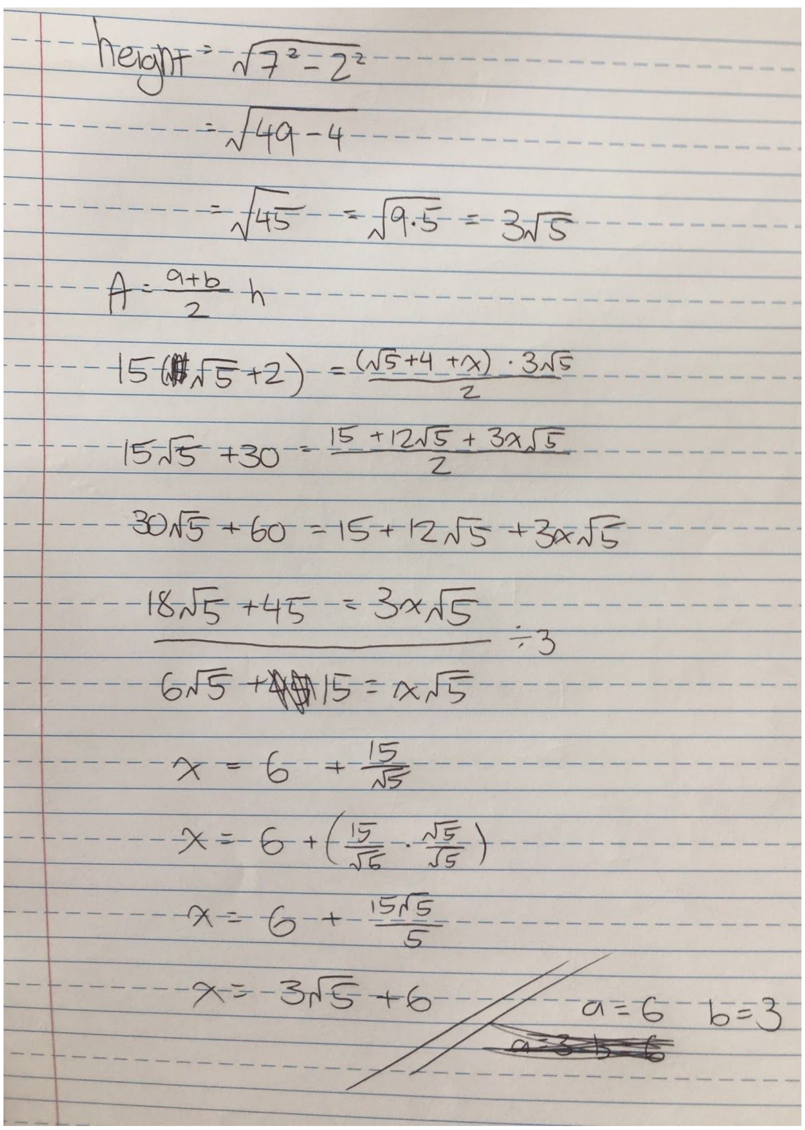
Ric 1:

DO NOT USE A CALCULATOR IN THIS QUESTION.



The diagram shows a trapezium ABCD in which AD = 7 cm and AB = $(4+\sqrt{5})$ cm.
AX is perpendicular to DC with DX = 2 cm and XC = x cm.
Given that the area of trapezium ABCD is $15(\sqrt{5}+2)\,cm^2$, obtain an expression for x in the form $a+b\sqrt{5}$, where a and b are integers.

Ame 1:



height $=\sqrt{7^2-2^2}$

$=\sqrt{49-4}$

$=\sqrt{45}=\sqrt{9\cdot5}=3\sqrt{5}$

$A=\frac{a+b}{2}h$

$15(\sqrt{5}+2)=\frac{(\sqrt{5}+4+x)\cdot3\sqrt{5}}{2}$

$15\sqrt{5}+30=\frac{15+12\sqrt{5}+3x\sqrt{5}}{2}$

$30\sqrt{5}+60=15+12\sqrt{5}+3x\sqrt{5}$

$18\sqrt{5}+45=3x\sqrt{5}$ $\div 3$

$6\sqrt{5}+15=x\sqrt{5}$

$x=6+\frac{15}{\sqrt{5}}$

$x=6+\left(\frac{15}{\sqrt{5}}\cdot\frac{\sqrt{5}}{\sqrt{5}}\right)$

$x=6+\frac{15\sqrt{5}}{5}$

$x=3\sqrt{5}+6$

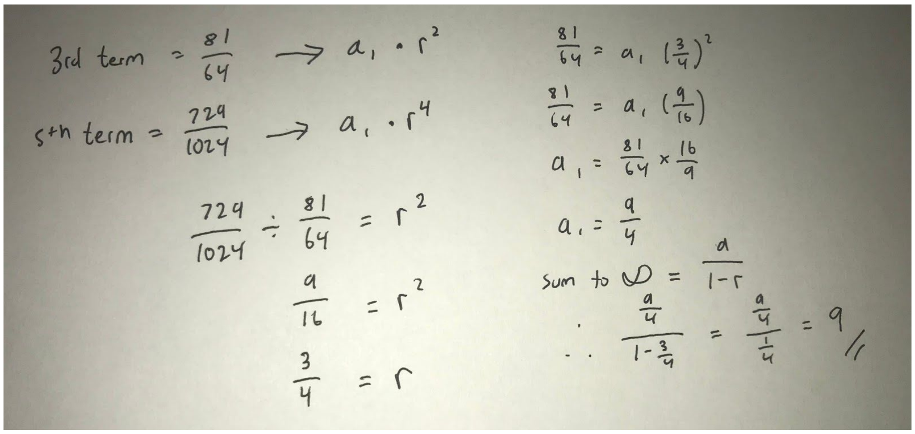
a = 6 b = 3

~~a = 3 b = 6~~

Ric 2:

A geometric progression is such that its 3^{rd} term is equal to $\frac{81}{64}$ and its 5th term is equal to $\frac{729}{1024}$. Find the first term of this progression and the positive common ratio of this progression. Hence find the sum to infinity of this progression.

Nev #2



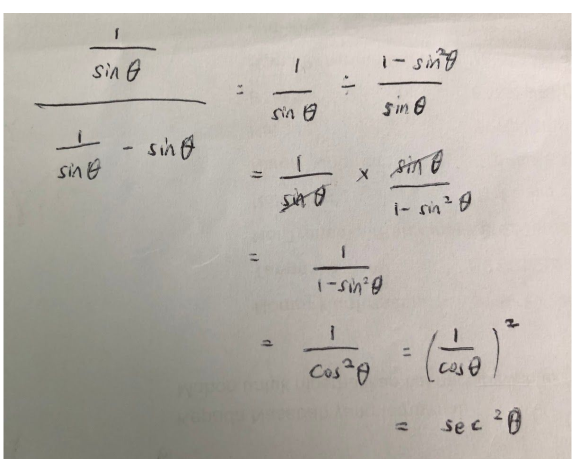
Ric 3:

Simplify $\log\sqrt{2} + log_a 8 + log_a \frac{1}{2}$, giving your answer in the form $p\ log_a 2$, where *p* is a constant.

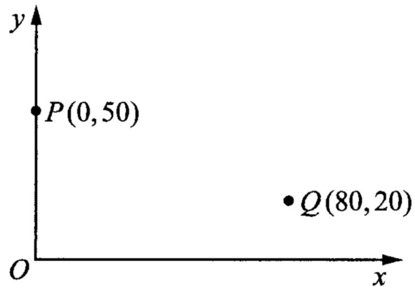
Ric 4:

Show that $\frac{cosec\ \theta}{cosec\ \theta - sin\ \theta}$ = $sec^2\theta$.

Cha #4

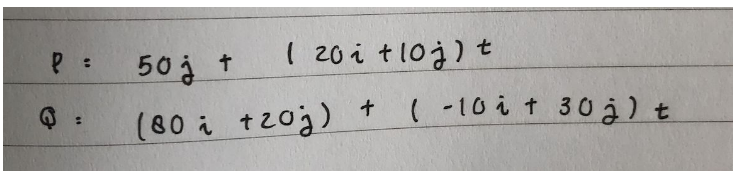


Ric 5:



At 1200 hours, ship *P* is at the point with position vector 50**j** km and ship Q is at the point with position vector (80**i** + 20**j**) km, as shown in the diagram. Ship P is travelling with constant velocity (20**i** + 10**j**) $\frac{km}{h}$ and ship Q is travelling with velocity (-10**i** + 30**j**) $\frac{km}{h}$. Find an expression for the position vector of *P* and of Q at time *t* hours after 1200 hours.

Cho ANS #3

- 
P : 50j + (20i + 10j) t
Q : (80i + 20j) + (-10i + 30j) t

Ame 1:

A five-digit code is formed using the following characters.

Letters	a e i o u
Numbers	1 2 3 4 5 6
Symbols	@ * #

No character can be repeated in a code. Find the number of possible codes if

(i) there are no restrictions,

(ii) the code starts with a symbol followed by two letters and then two numbers,

(iii) the first two characters are numbers, and no other numbers appear in the code.

Nev #1

i) 14P5 = 240240

ii)3P1 x 5P2 x 6P2 = 1800

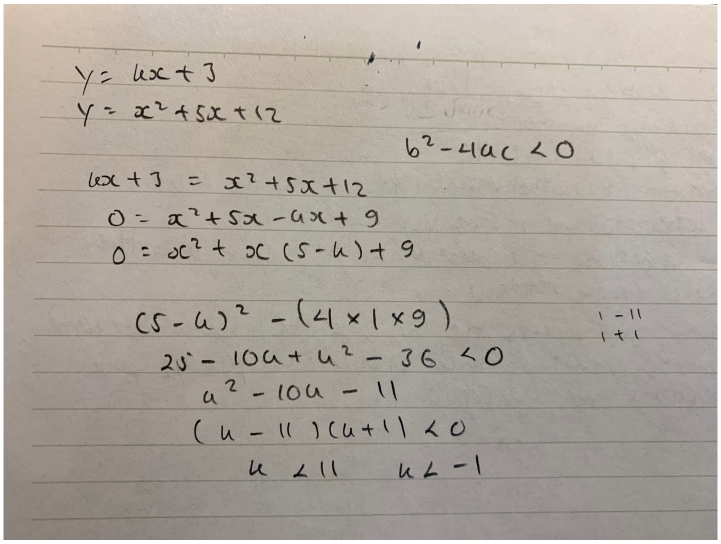
iii)6P2 x 8P3 = 10080

Ame 2:

Find the values of *k* for which the line $y = kx + 3$ does not meet the curve $y = x^2 + 5x + 12$

.

Eze #1



$y = kx + 3$

$y = x^2 + 5x + 12$

$b^2 - 4ac < 0$

$kx + 3 = x^2 + 5x + 12$

$0 = x^2 + 5x - kx + 9$

$0 = x^2 + x(5 - k) + 9$

$(5 - k)^2 - (4 \times 1 \times 9)$

$25 - 10k + k^2 - 36 < 0$

$k^2 - 10k - 11$

$(k - 11)(k + 1) < 0$

$k < 11 \quad k < -1$

1 −11

1 +1

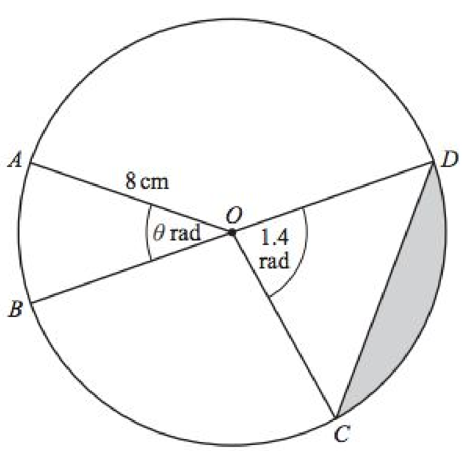
Ame 3:

The diagram shows a circle with centre *O* and radius 8cm. The points *A*, *B*, *C* and *D* lie on the circumference of the circle. Angle *AOB* = θ radians and angle *COD* = 1.4 radians. The area of sector AOB is 20 cm^2.

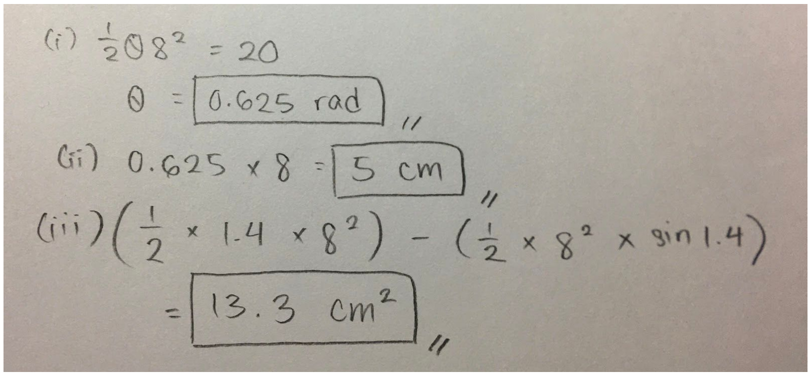
(i) Find angle θ.

(ii) Find the length of the arc *AB*.

(iii) Find the area of the shaded segment



Glo #3


(i) $\frac{1}{2}\theta 8^2 = 20$

$\theta = \boxed{0.625 \text{ rad}}$ //

(ii) $0.625 \times 8 = \boxed{5 \text{ cm}}$ //

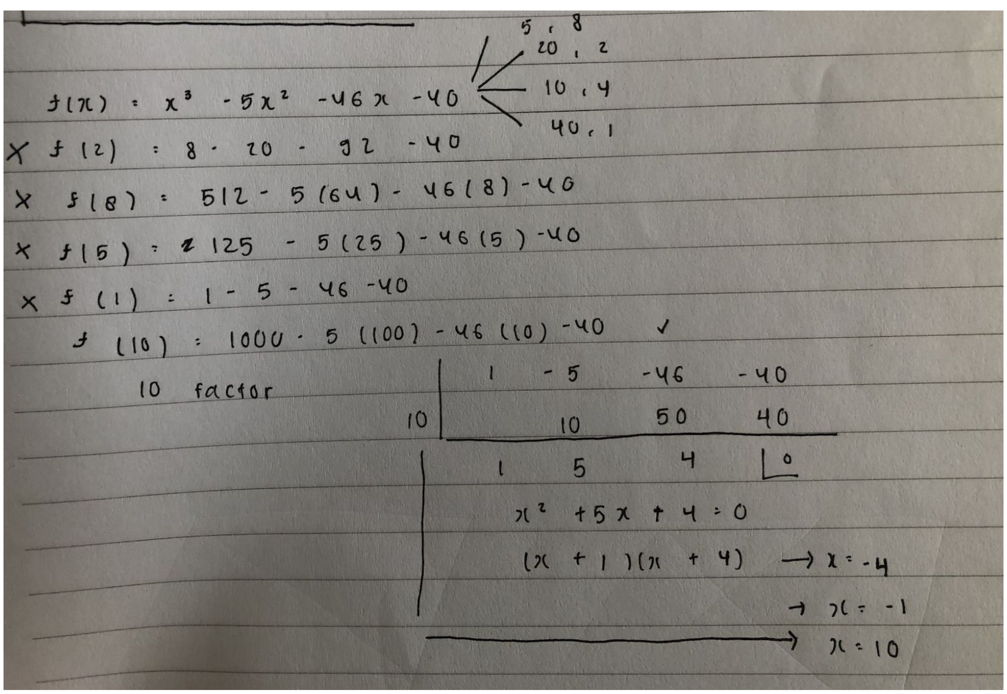
(iii) $\left(\frac{1}{2} \times 1.4 \times 8^2\right) - \left(\frac{1}{2} \times 8^2 \times \sin 1.4\right)$

$= \boxed{13.3 \text{ cm}^2}$ //

Ame 4: **(Do not use a calculator in this question.)**

Solve the equation $x^3 - 5x^2 - 46x - 40 = 0$ given that it has three integer roots, only one of which is positive

Cho #4


5, 8
20, 2
10, 4
40, 1

$f(x) = x^3 - 5x^2 - 46x - 40$

× $f(2) = 8 - 20 - 92 - 40$

× $f(8) = 512 - 5(64) - 46(8) - 40$

× $f(5) = 125 - 5(25) - 46(5) - 40$

× $f(1) = 1 - 5 - 46 - 40$

$f(10) = 1000 - 5(100) - 46(10) - 40$ ✓

10 factor

10	1	−5	−46	−40
		10	50	40
	1	5	4	0

$x^2 + 5x + 4 = 0$

$(x+1)(x+4)$ → $x = -4$

→ $x = -1$

→ $x = 10$

x= -4, -1, 10

Ame 5: **(Do not use a calculator in this question.)**

In this question, all lengths are in centimetres.
A triangle ABC is such that angle $B = 90°$, $AB = 5\sqrt{3} + 5$, and $BC = 5\sqrt{3} - 5$

(i) Find, in its simplest surd form, the length of *AC*.

(ii) Find $tanBCA$, giving your answer in the form $a + b\sqrt{3}$, where *a* and *b* are integers.

Cha #5

i) $AC^2 = (5\sqrt{3}+5)^2 + (5\sqrt{3}-5)^2 = 75 + 50\sqrt{3} + 25 + 75 - 50\sqrt{3} + 25 = 200$

$AC = \sqrt{200}$

ii) tan BCA = $\frac{5\sqrt{3}+5}{5\sqrt{3}-5}$ = $2 + 1\sqrt{3}$

Nev 1

Differentiate with respect to x

(i) $4x\ tan\ x$

(ii) $\frac{e^{3x+1}}{x^2-1}$

Cho #5

(i) $4x \tan x$

$u = 4x$ $v = \tan x$

$u' = 4$ $v' = \sec^2 x$

$\frac{dy}{dx} = 4\tan x - 4x\sec^2 x$

(ii) $\frac{e^{3x+1}}{x^2-1}$

$u = e^{3x+1}$ $v = x^2 - 1$

$u' = 3e^{3x+1}$ $v' = 2x$

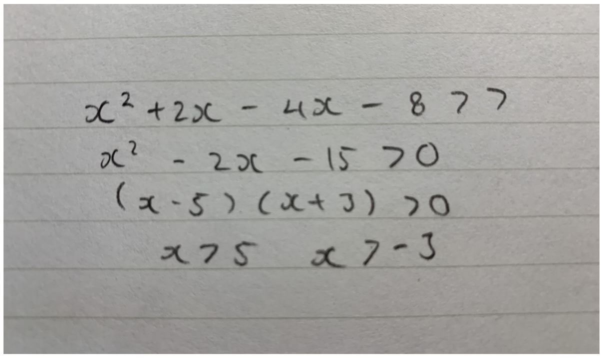
$\frac{dy}{dx} = \frac{(x^2-1)(3e^{3x+1}) - (2xe^{3x+1})}{(x^2-1)^2}$

$= \frac{(3x^2-2x-3)(e^{3x+1})}{(x^2-1)^2}$

Nev 2

Find the values of x for which $(x-4)(x+2) > 7$

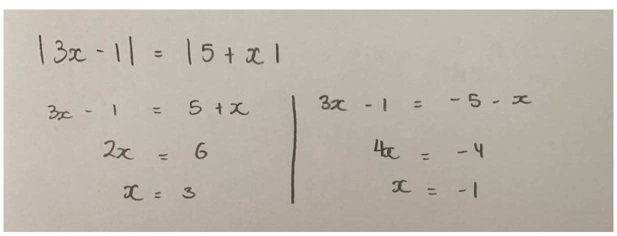
Eze #2



Nev 3

Solve the equation $|3x-1| = |5+x|$.

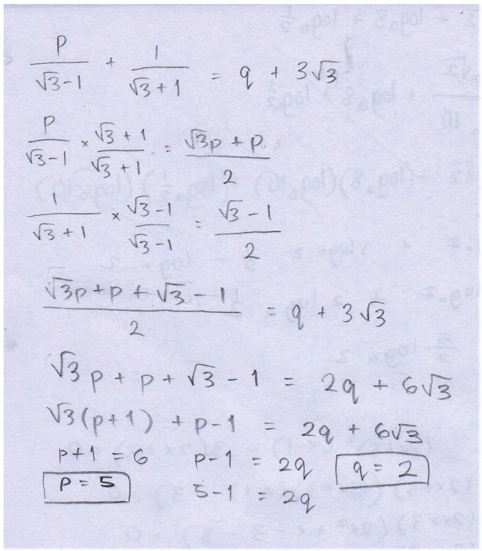
Bel #1



Nev 4

Find integers p and q such that $\frac{p}{\sqrt{3}-1} + \frac{1}{\sqrt{3}+1} = q + 3\sqrt{3}$

Glo #4


$$\frac{p}{\sqrt{3}-1} + \frac{1}{\sqrt{3}+1} = q + 3\sqrt{3}$$
$$\frac{p}{\sqrt{3}-1} \times \frac{\sqrt{3}+1}{\sqrt{3}+1} = \frac{\sqrt{3}p + p}{2}$$
$$\frac{1}{\sqrt{3}+1} \times \frac{\sqrt{3}-1}{\sqrt{3}-1} = \frac{\sqrt{3}-1}{2}$$
$$\frac{\sqrt{3}p + p + \sqrt{3} - 1}{2} = q + 3\sqrt{3}$$
$$\sqrt{3}p + p + \sqrt{3} - 1 = 2q + 6\sqrt{3}$$
$$\sqrt{3}(p+1) + p - 1 = 2q + 6\sqrt{3}$$
$p + 1 = 6$ $p - 1 = 2q$ $q = 2$

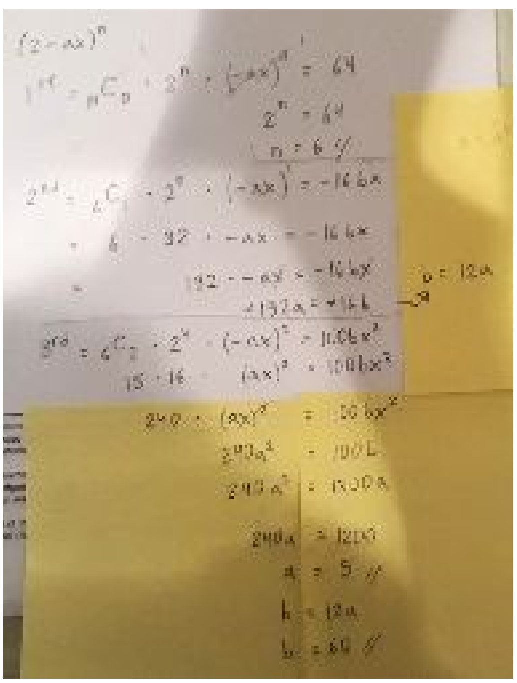
$p = 5$ $5 - 1 = 2q$

Nev 5

The first three terms of the binomial expansion of $(2 - ax)^n$ are $64 - 16bx + 100bx^2$.

Find the value of each of the integers n, a and b.

Gab #2


$(2-ax)^n$

$1^{st} = {}_nC_0 \cdot 2^n \cdot (-ax)^0 = 64$

$2^n = 64$

$n = 6$

$2^{nd} = {}_6C_1 \cdot 2^5 \cdot (-ax)^1 = -16bx$

$6 \cdot 32 \cdot -ax = -16bx$

$192 \cdot -ax = -16bx$

$-192a = -16b$ $b = 12a$

$3^{rd} = {}_6C_2 \cdot 2^4 \cdot (-ax)^2 = 100bx^2$

$15 \cdot 16 \cdot (ax)^2 = 100bx^2$

$240 \cdot (ax)^2 = 100bx^2$

$240a^2 = 100b$

$240a^2 = 1200a$

$240a = 1200$

$a = 5$

$b = 12a$

$b = 60$

Bel 1

- Write down the amplitude and period of $4sin3x - 1$.

Ric 3:

Amplitude: 4 units

Period: 120º

Bel 2

- The polynomial $p(x) = (2x-1)(x+k) - 12$, where k is a constant. When p(x) is divided by $x+3$ the remainder is 23. Find the value of k.

Jos #1:

$(2x-1)(x+k) - 12 = 2x^2 + 2kx - x - k - 12$

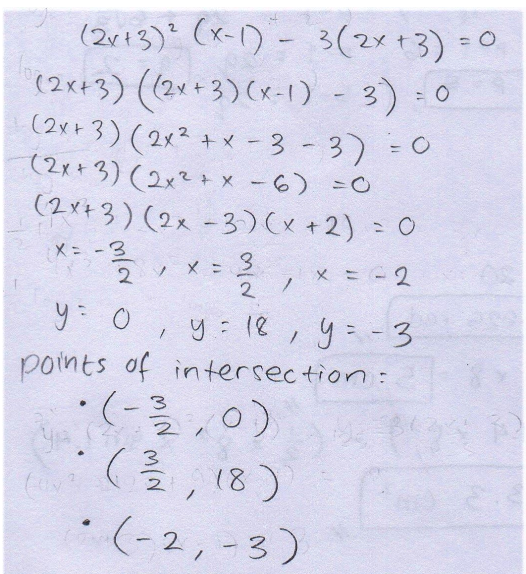
$p(-3) = \; 9 - 7k = 23$

$k = -2$

Bel 3

- **Do not use a calculator in this question.** Find the coordinates of the points of intersection of the curve y = $(2x+3)^2(x-1)$ and the line $y = 3(2x+3)$.

Glo #5



$(2x+3)^2(x-1) - 3(2x+3) = 0$

$(2x+3)((2x+3)(x-1) - 3) = 0$

$(2x+3)(2x^2 + x - 3 - 3) = 0$

$(2x+3)(2x^2 + x - 6) = 0$

$(2x+3)(2x-3)(x+2) = 0$

$x = -\frac{3}{2}, \; x = \frac{3}{2}, \; x = -2$

$y = 0, \; y = 18, \; y = -3$

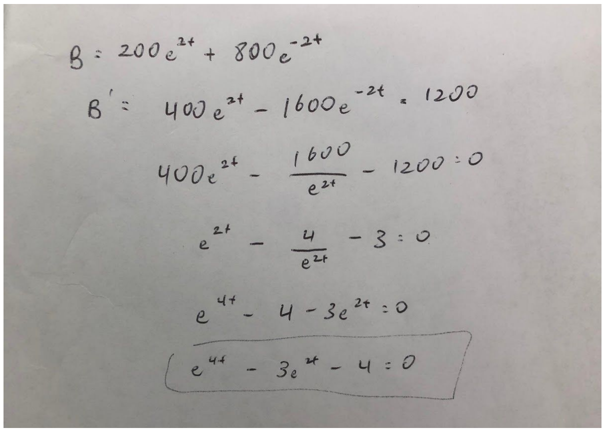
points of intersection:

- $(-\frac{3}{2}, 0)$
- $(\frac{3}{2}, 18)$
- $(-2, -3)$

Bel 4

- The number, B, of a certain type of bacteria at time t days can be described by $B = 200e^{2t} + 800e^{-2t}$. At the instant when $\frac{dB}{dt} = 1200$, show that $e^{4t} - 3e^{2t} - 4 = 0$.

Cha #4



$B = 200e^{2t} + 800e^{-2t}$

$B' = 400e^{2t} - 1600e^{-2t} = 1200$

$400e^{2t} - \frac{1600}{e^{2t}} - 1200 = 0$

$e^{2t} - \frac{4}{e^{2t}} - 3 = 0$

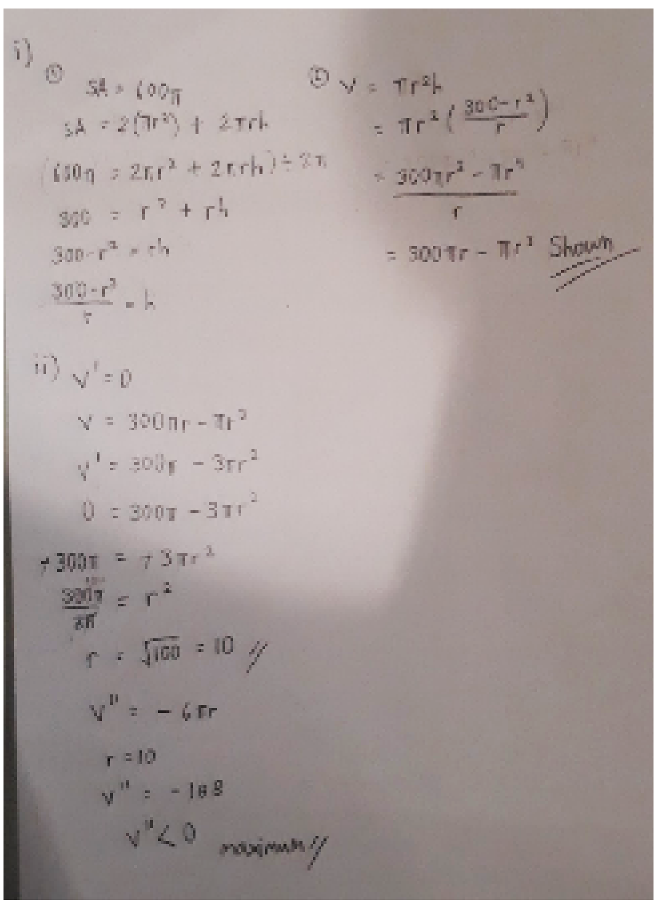
$e^{4t} - 4 - 3e^{2t} = 0$

$e^{4t} - 3e^{2t} - 4 = 0$

Bel 5

- A closed cylinder has base radius r, height h, and volume V. It is given that the total surface area of the cylinder is 600π and that V, r, and h can vary.
  i.) Show that $V = 300\pi r - \pi r^3$
  ii.) Find the stationary value of V and determine its nature.

Gab #1



i) ① $SA = 600\pi$

$SA = 2(\pi r^2) + 2\pi rh$

$(600\pi = 2\pi r^2 + 2\pi rh) \div 2\pi$

$300 = r^2 + rh$

$300 - r^2 = rh$

$\frac{300 - r^2}{r} = h$

② $V = \pi r^2 h$

$= \pi r^2 \left(\frac{300 - r^2}{r}\right)$

$= \frac{300\pi r^2 - \pi r^4}{r}$

$= 300\pi r - \pi r^3$ Shown

ii) $V' = 0$

$V = 300\pi r - \pi r^3$

$V' = 300\pi - 3\pi r^2$

$0 = 300\pi - 3\pi r^2$

$-300\pi = -3\pi r^2$

$\frac{300\pi}{3\pi} = r^2$

$r = \sqrt{100} = 10$

$V'' = -6\pi r$

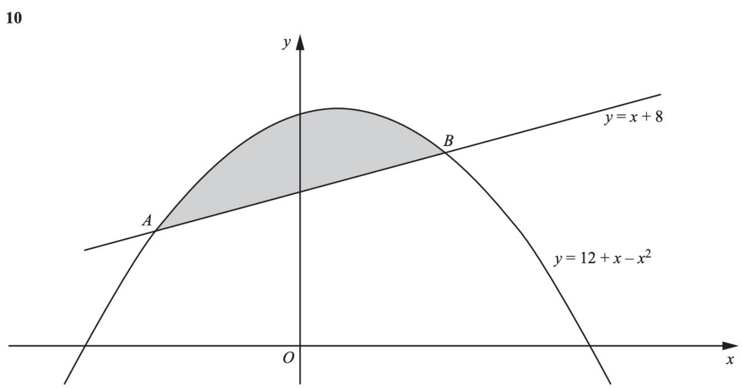
$r = 10$

$V'' = -188$

$V'' < 0$ maximum

Gab 1

The diagram shows the curve $y = 12 + x - x^2$ intersecting the line $y = x + 8$ at the points A and B.

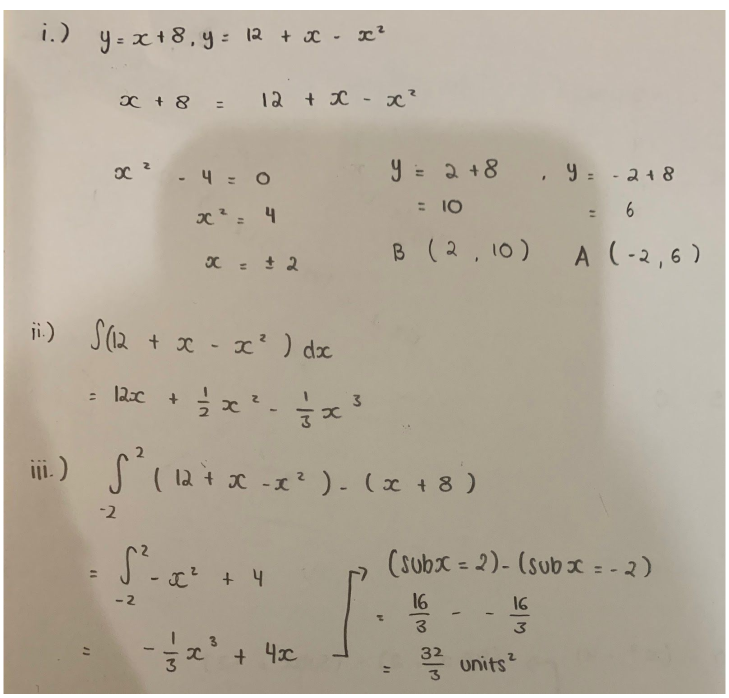


(i) find the coordinates of the points A and B

(ii) find $\int (12 + x - x^2)\, dx$

(iii) showing all your working, find the area of the shaded region

Bel #4



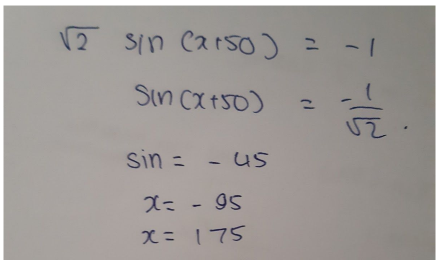
Gab 2

Find the equation of the normal to the curve $y = \frac{ln(3x^2+1)}{x^2}$ at the point where $x = 2$, giving your answer in the form $y = mx + c$, where m and c are correct to 2 decimal places. You must show all your working.

Gab 3

Solve $1 + \sqrt{2}\, sin(x + 50^\circ) = 0$ for $-180^\circ \le x \le 180^\circ$.

Fel 1:



Gab 4

A quiz team of 6 children is to be chosen from a class of 8 boys and 10 girls. Find the number of ways of choosing the team if

(i) there are no restrictions,

(ii) there are more boys than girls in the team

Glo #1

(i) 18C6 = **18564**

(ii) 8C6 + 8C5 x 10C1 + 8C4 x 10C2 = **3738**

Gab 5

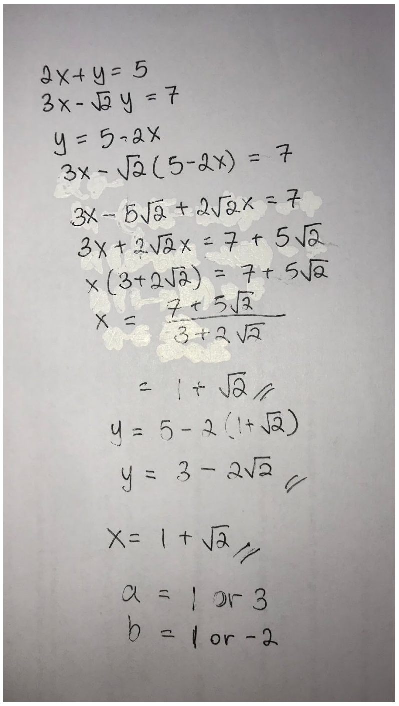
Do not use a calculator in this question

Solve the following simultaneous equations, giving your answers for both x and y in the form $a + b\sqrt{2}$, where a and b are integers.

$$2x + y = 5$$

$$3x - \sqrt{2}y = 7$$

Ric 4:



$2x + y = 5$

$3x - \sqrt{2}y = 7$

$y = 5 - 2x$

$3x - \sqrt{2}(5 - 2x) = 7$

$3x - 5\sqrt{2} + 2\sqrt{2}x = 7$

$3x + 2\sqrt{2}x = 7 + 5\sqrt{2}$

$x(3 + 2\sqrt{2}) = 7 + 5\sqrt{2}$

$x = \frac{7 + 5\sqrt{2}}{3 + 2\sqrt{2}}$

$= 1 + \sqrt{2}$ //

$y = 5 - 2(1 + \sqrt{2})$

$y = 3 - 2\sqrt{2}$ //

$X = 1 + \sqrt{2}$ //

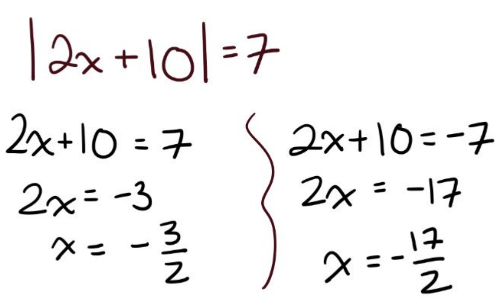
$a = 1$ or 3

$b = 1$ or -2

Fel 1: solve for x

$$|2x + 10| = 7\,.$$

Ame 4:



$|2x + 10| = 7$

$2x + 10 = 7$ | $2x + 10 = -7$

$2x = -3$ | $2x = -17$

$x = -\frac{3}{2}$ | $x = -\frac{17}{2}$

Fel 2: Solve the equation

A. $lg(5x + 10) + 2lg3 = 1 + lg(4x + 12)$

B. $\frac{9^{2y}}{3^{7-y}} = \frac{3^{4y+3}}{27^{y-2}}$

Emi #5:

A. $\log(5x+10) + \log(3^2) = \log 10 + \log(4x+12)$

$(5x+10) \times (3^2) = (10) \times (4x+12)$

$45x + 90 = 40x + 120$

$5x = 30$

$x = 6$

B. $\frac{(3^2)^{2y}}{3^{7-y}} = \frac{3^{4y+3}}{(3^3)^{y-2}}$

$4y - (7-y) = 4y+3 - (3y-6)$

$5y - 7 = y + 9$

$4y = 16$

$y = 4$

Fel 3:

$3\ sec\ x\ =\ 10,\ for\ 0 \le x \le 6\ \ radians$

Fel 4:

A particle moves in a straight so that , at time t s after passing a fixed point O, its velocity is $v\ ms^{-1}$ where $v = 6t\ +\ 4cos2t.$

Find

Jos #4

A. The velocity of the particle at the instant it passes O

$t = 0,\ v = 4cos2(0)$

$v = 4m/s$

B. The acceleration of the particle when t= 5

$t = 5\ ,\ v' = 6 - 8sin2t$

$a = 10.4\ m/s^2$

C. The greatest value of the acceleration

$a = 6 - 8sin2t\ ,\ a' = 0$

$a' = 16cos2t\ \ = 0$

$t = \frac{cos^{-1}(0)}{2} \quad = 0.79s$

D. The distance travelled in the fifth second

$\int 6t + 4cos2t\ dx$

$\int 3t^2 + 2sin2t + c\ ,\ \ t = 0$

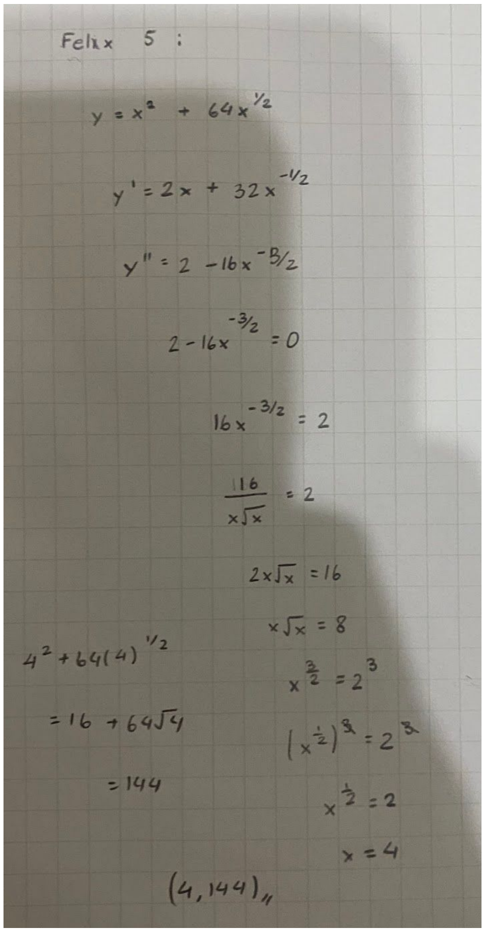
$d = 3t^2 + 2\ sin2t,\ \ t = 5$

$d = 73.9m$

Fel 5:

Given that a curve has equation $x^2 + 64\sqrt{x},$ find the coordinates of the point on the curve where $\frac{d^2y}{dx^2}$ = 0

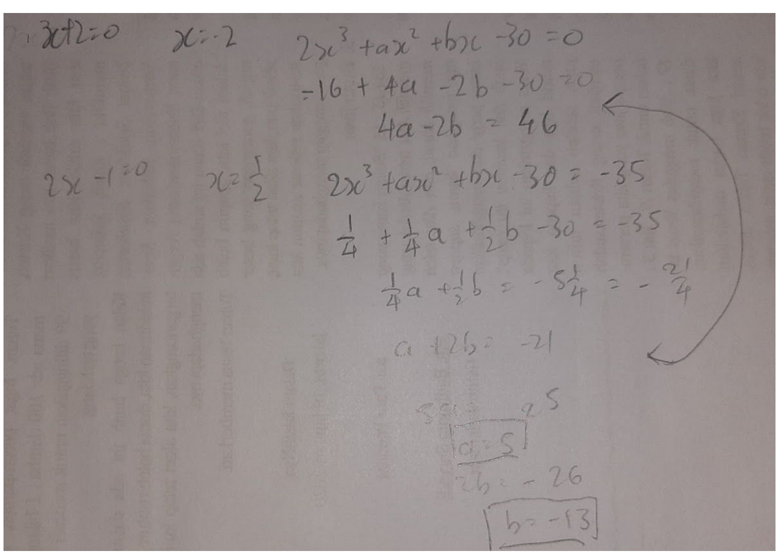
Est 5 :



Yon 1a

The expression 2x³ + ax² + bx -30 is divisible by x + 2 and leaves a remainder of –35 when divided by 2x – 1. Find the values of the constants a and b.

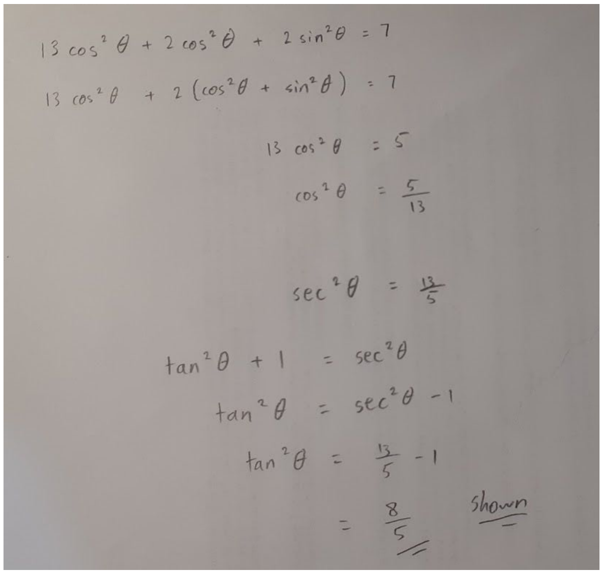
Ehr 1:



Yon 2

Given that 15cos²θ + 2sin² θ = 7, show that $tan^2\theta = \frac{8}{5}$.

Jos #3



$13\cos^2\theta + 2\cos^2\theta + 2\sin^2\theta = 7$

$13\cos^2\theta + 2(\cos^2\theta + \sin^2\theta) = 7$

$13\cos^2\theta = 5$

$\cos^2\theta = \frac{5}{13}$

$\sec^2\theta = \frac{13}{5}$

$\tan^2\theta + 1 = \sec^2\theta$

$\tan^2\theta = \sec^2\theta - 1$

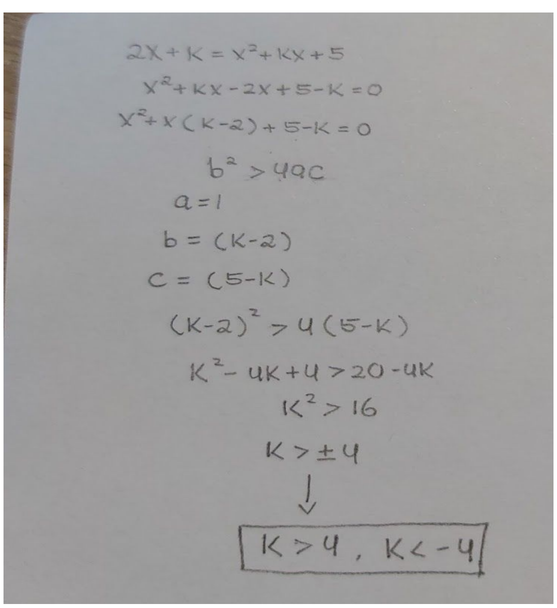
$\tan^2\theta = \frac{13}{5} - 1$

$= \frac{8}{5}$ Shown

Yon 3

Find the set of values of k for which the line y = 2x + k cuts the curve y = x² + kx + 5 at two distinct points.

Chr #1



$2X + K = X^2 + KX + 5$

$X^2 + KX - 2X + 5 - K = 0$

$X^2 + X(K-2) + 5 - K = 0$

$b^2 > 4ac$

$a = 1$

$b = (K-2)$

$C = (5-K)$

$(K-2)^2 > 4(5-K)$

$K^2 - 4K + 4 > 20 - 4K$

$K^2 > 16$

$K > \pm 4$

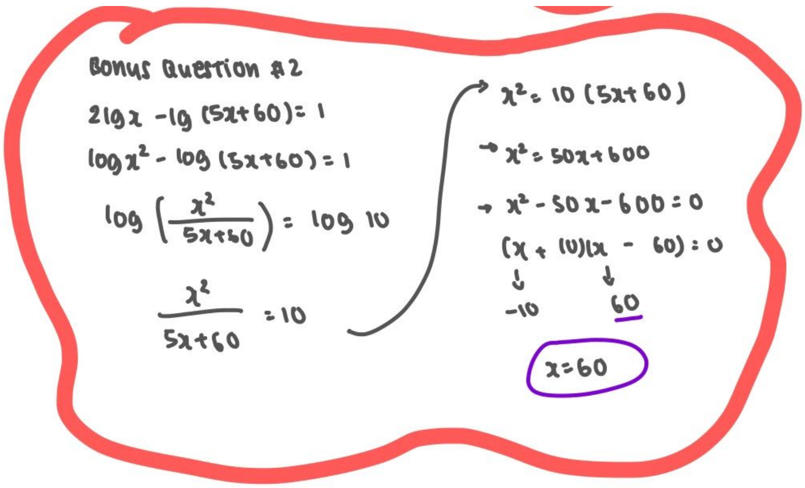
↓

$K > 4, K < -4$

Yon 4

Find the value of x for which 2lg x – lg(5x + 60) = 1 .

Kay 2



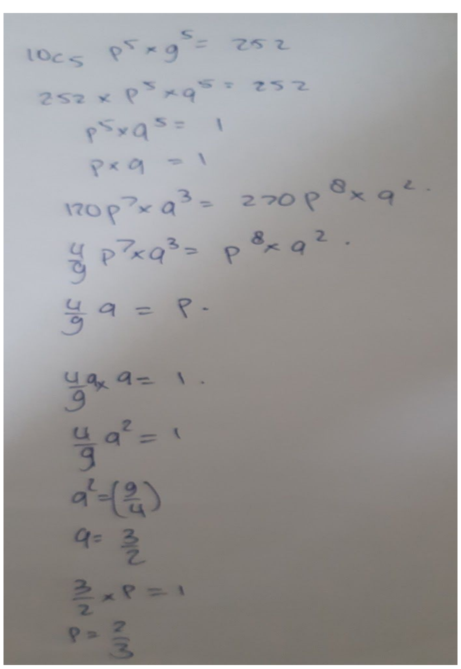
Yon 5

Find the values of the positive constants p and q such that, in the binomial expansion of (p + qx)^{10} , the coefficient of x^5 is 252 and the coefficient of x^3 is 6 times the coefficient of x^2.

$$(a+b)^n = a^n + \binom{n}{1} \times a^{n-1} \times b + \binom{n}{2} \times a^{n-2} \times b^2 + \binom{n}{r} \times a^{n-r} \times b^r + \ldots\ldots$$

Where n is a positive integer and $\binom{n}{r} = \frac{n!}{(n-r)!r!}$

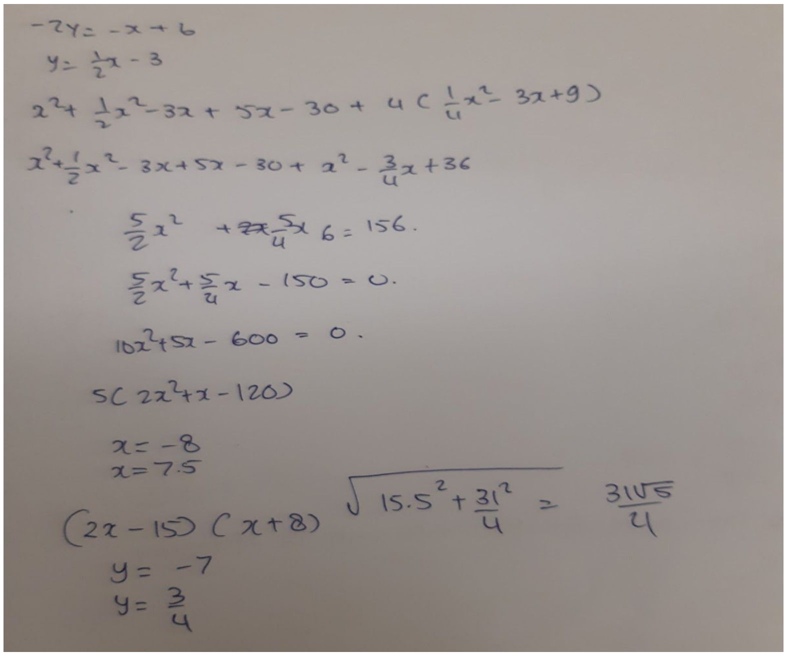
Fel 3:



Pri 1

The line x - 2y = 6 intersects at the curve x^2 + xy + 10y + $4y^2$ = 156 at the points A and B. Find the length of AB

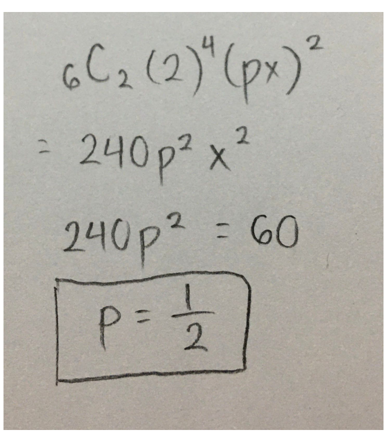
Fel 4:



Pri 2

Given that the coefficient of x^2 in the expansion of $(2+px)^6$ is 60, find the value of the positive constant *p*.

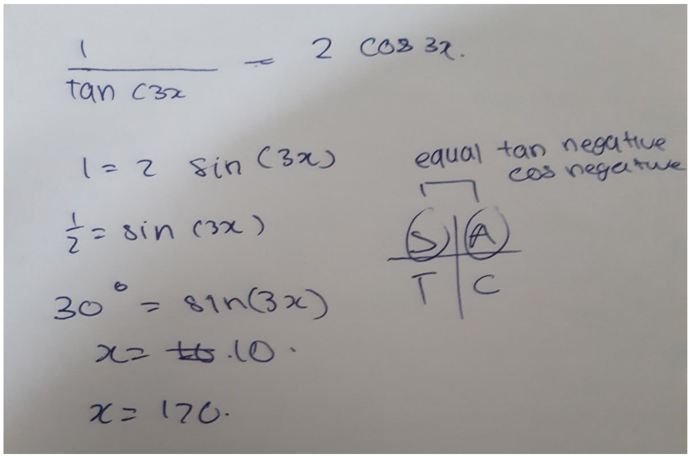
Glo #2



Pri 3

Solve $2cos3x = cot3x$ for 0° □ x □ 360°

Fel 2



$\frac{1}{\tan(3x)} = 2\cos 3x.$

$1 = 2\sin(3x)$

$\frac{1}{2} = \sin(3x)$

$30^\circ = \sin(3x)$

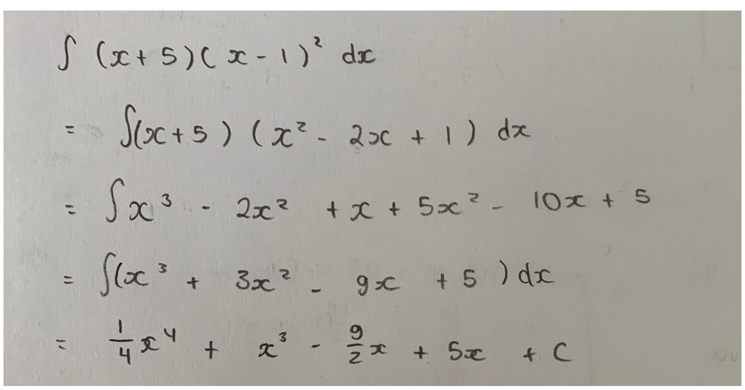
$x = 10.$

$x = 170.$

Pri 4

Find $\int (x+5)(x-1)^2\, dx$

Bel #5



$\int (x+5)(x-1)^2\, dx$

$= \int (x+5)(x^2 - 2x + 1)\, dx$

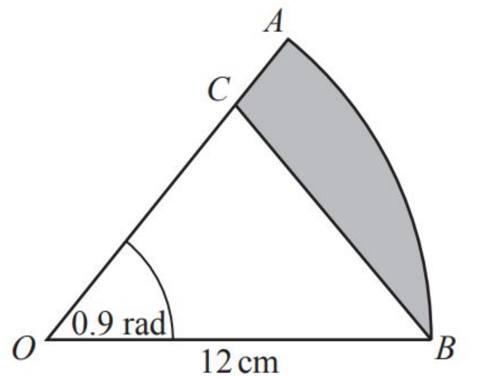
$= \int x^3 - 2x^2 + x + 5x^2 - 10x + 5$

$= \int (x^3 + 3x^2 - 9x + 5)\, dx$

$= \frac{1}{4}x^4 + x^3 - \frac{9}{2}x + 5x + C$

Pri 5

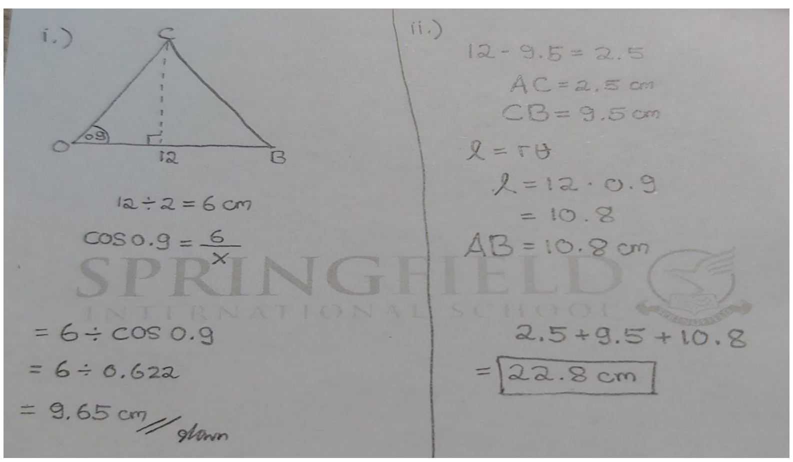
The diagram shows a sector, AOB, of a circle centre 0, radius 12 cm. Angle AOB = 0.9 radians. The point C lies on OA such that OC=OB



(i) Show that OC = 9.5cm correct to 3 significant figures.

(ii) Find the perimeter of the shaded region.

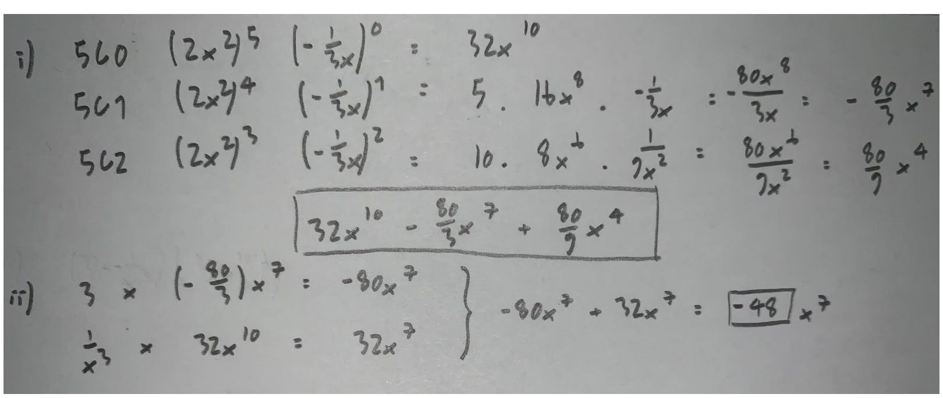
Chr #2



Glo 1

Find the first 3 terms in the expansion of $(2x^2 - \frac{1}{3x})^5$, in descending powers of x. Hence find the coefficient of x^7 in the expansion of $(3 + \frac{1}{x^3})\,(2x^2 - \frac{1}{3x})^5$.

Emi #1:



Glo 2

The variables x and y are such that when $\ln y$ is plotted against x, a straight line graph is obtained. This line passes through the points $x = 4$, $\ln y = 0.20$ and $x = 12$, $\ln y = 0.08$. Given that $y = Ab^x$, find the value of A and of b.

Glo 3

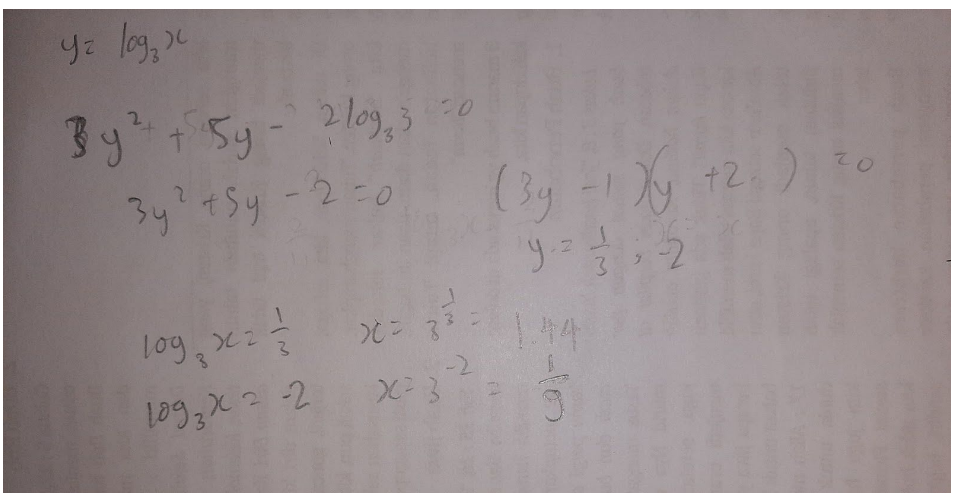
Find the equation of the normal to the curve $y = \frac{1}{2}ln(3x+2)$ at the point P where $x = -\frac{1}{3}$.

Glo 4

By using the substitution $y = log_3 x$, or otherwise, find the values of x for which

$$3(log_3 x)^2 + log_3 x^5 - log_3 9 = 0.$$

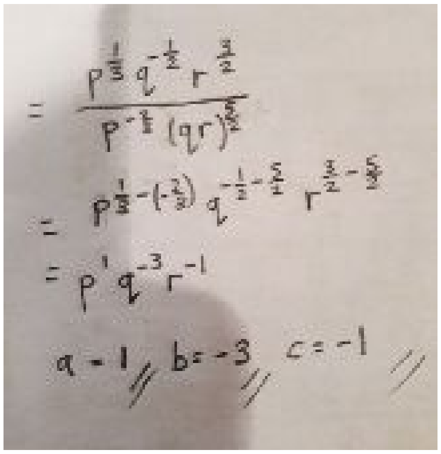
Ehr 4



Glo 5

Given that $\frac{p^{\frac{1}{3}} q^{-\frac{1}{2}} r^{\frac{3}{2}}}{p^{-\frac{2}{3}}\sqrt{(qr)^5}} = p^a q^b r^c$, find the value of each of the integers a, b and c.

Gab #4



$$= \frac{p^{\frac{1}{3}} q^{-\frac{1}{2}} r^{\frac{3}{2}}}{p^{-\frac{2}{3}} (qr)^{\frac{5}{2}}}$$

$$= p^{\frac{1}{3}-(-\frac{2}{3})} q^{-\frac{1}{2}-\frac{5}{2}} r^{\frac{3}{2}-\frac{5}{2}}$$

$$= p^{1} q^{-3} r^{-1}$$

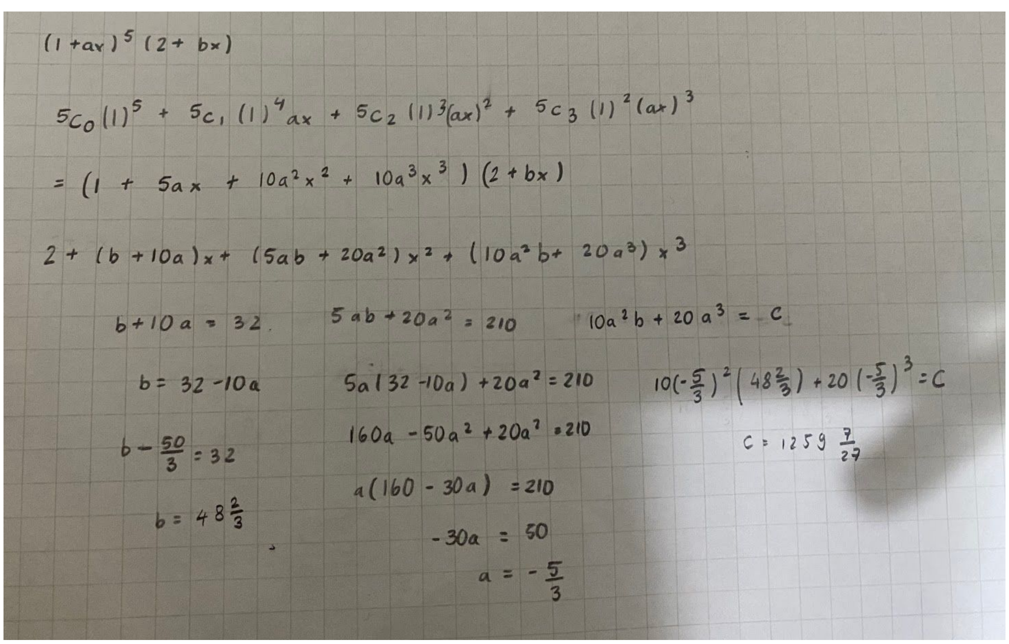
$a = 1$, $b = -3$, $c = -1$

Emi 1:

The first four terms in the expansion of $(1+ax)^5(2+bx)$ are $2+32x+210x^2+cx^3$, where a, b and c are integers. Show that $3a^2-16a+21=0$.

Hence find the value of a, b and c.

Est4 :



$(1+ax)^5 (2+bx)$

${}^5C_0 (1)^5 + {}^5C_1 (1)^4 ax + {}^5C_2 (1)^3 (ax)^2 + {}^5C_3 (1)^2 (ax)^3$

$= (1 + 5ax + 10a^2x^2 + 10a^3x^3)(2+bx)$

$2 + (b+10a)x + (5ab+20a^2)x^2 + (10a^2b + 20a^3)x^3$

$b+10a = 32$

$b = 32-10a$

$b - \frac{50}{3} = 32$

$b = 48\frac{2}{3}$

$5ab + 20a^2 = 210$

$5a(32-10a) + 20a^2 = 210$

$160a - 50a^2 + 20a^2 = 210$

$a(160-30a) = 210$

$-30a = 50$

$a = -\frac{5}{3}$

$10a^2b + 20a^3 = c$

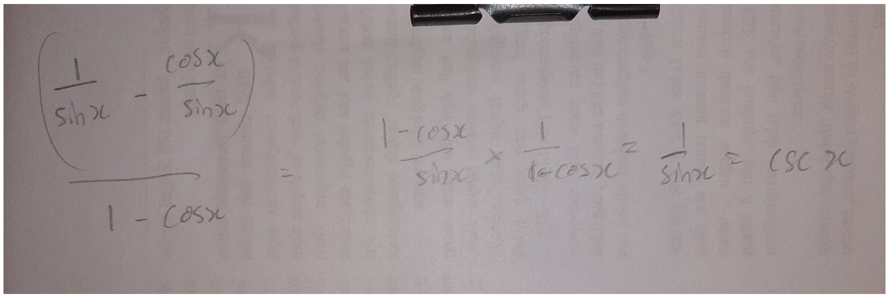
$10(-\frac{5}{3})^2(48\frac{2}{3}) + 20(-\frac{5}{3})^3 = c$

$c = 1259\frac{7}{27}$

Emi 2:

Show that $\frac{cosecx - cotx}{1 - cosx} = cosec\,x$.

Ehr 2

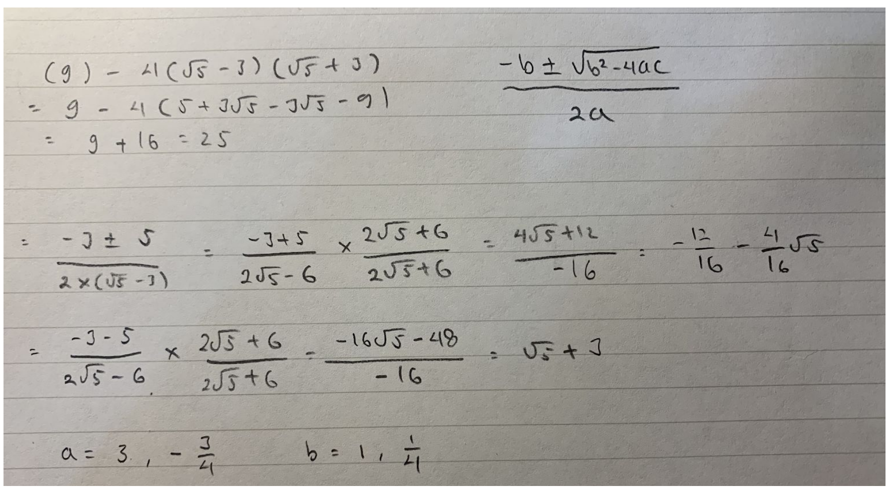


$$\frac{\left(\frac{1}{\sin x} - \frac{\cos x}{\sin x}\right)}{1 - \cos x} = \frac{1-\cos x}{\sin x} \times \frac{1}{1-\cos x} = \frac{1}{\sin x} = \csc x$$

Emi 3:

Solve the quadratic equation $(\sqrt{5} - 3)x^2 + 3x + (\sqrt{5} + 3) = 0$, giving your answers in the form of $a + b\sqrt{5}$, where a and b are constants.

Eze #3



$$(9) - 4(\sqrt{5} - 3)(\sqrt{5} + 3)$$
$$= 9 - 4(5 + 3\sqrt{5} - 3\sqrt{5} - 9)$$
$$= 9 + 16 = 25$$

$$\frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$

$$= \frac{-3 \pm 5}{2 \times (\sqrt{5} - 3)} = \frac{-3+5}{2\sqrt{5} - 6} \times \frac{2\sqrt{5} + 6}{2\sqrt{5} + 6} = \frac{4\sqrt{5} + 12}{-16} = -\frac{12}{16} - \frac{4}{16}\sqrt{5}$$

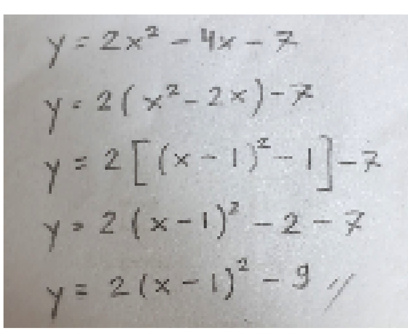
$$= \frac{-3-5}{2\sqrt{5} - 6} \times \frac{2\sqrt{5} + 6}{2\sqrt{5} + 6} = \frac{-16\sqrt{5} - 48}{-16} = \sqrt{5} + 3$$

$a = 3, -\frac{3}{4}$ $\quad b = 1, \frac{1}{4}$

Emi 4:

Given that $y = 2x^2 - 4x - 7$, write y in the form $a(x - b)^2 + c$, where a, b and c are constants.

Gab #5



$$y = 2x^2 - 4x - 7$$
$$y = 2(x^2 - 2x) - 7$$
$$y = 2[(x-1)^2 - 1] - 7$$
$$y = 2(x-1)^2 - 2 - 7$$
$$y = 2(x-1)^2 - 9$$

Emi 5:

Find the values of k for which the line $y = kx + 3$ does not meet the curve $y = x^2 + 5x + 12$.

Ald 2:

The points A(2, 11), B(-2, 3) and C(2, -1) are the vertices of a triangle. Find the equation of the perpendicular bisector of AB. **(Solutions to this question using accurate drawing is unacceptable)**

Ame 3

A - (2,11)
B - (-2,3)
C - (2,-1)

$m_{AB} = \frac{11-3}{2+2}$

$= \frac{8}{4}$

$= 2$

$m_1 \cdot m_2 = -1$

$2 \cdot m_2 = -1$

$m_2 = -\frac{1}{2}$

$y = -\frac{1}{2}x + c$

$M_{AB} = \left(\frac{2-2}{2}, \frac{11+3}{2}\right)$

$= (0, 7)$

$y = -\frac{1}{2}x + c \quad (0,7)$

$7 = c$

$y = -\frac{1}{2}x + 7$

Ald 3:

Given that y=4sin6x, write down:

i) the amplitude of y.

ii) the period of y

Ame 2:

i) A = 4 units

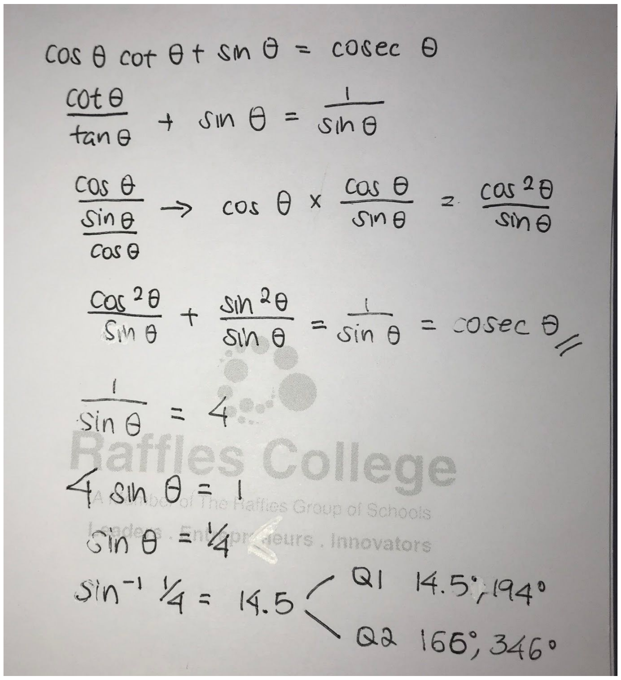
ii) T = $360° \div 6 = 60°$

Est 1:

i) Show that cosθcotθ+sinθ = cosec θ.

ii) Hence, solve cosθcotθ+sinθ = 4 for 0° ≤ θ ≤ 360°

Ric 5:



$\cos\theta \cot\theta + \sin\theta = \operatorname{cosec}\theta$

$\frac{\cot\theta}{\tan\theta} + \sin\theta = \frac{1}{\sin\theta}$

$\frac{\frac{\cos\theta}{\sin\theta}}{\cos\theta} \rightarrow \cos\theta \times \frac{\cos\theta}{\sin\theta} = \frac{\cos^2\theta}{\sin\theta}$

$\frac{\cos^2\theta}{\sin\theta} + \frac{\sin^2\theta}{\sin\theta} = \frac{1}{\sin\theta} = \operatorname{cosec}\theta$ //

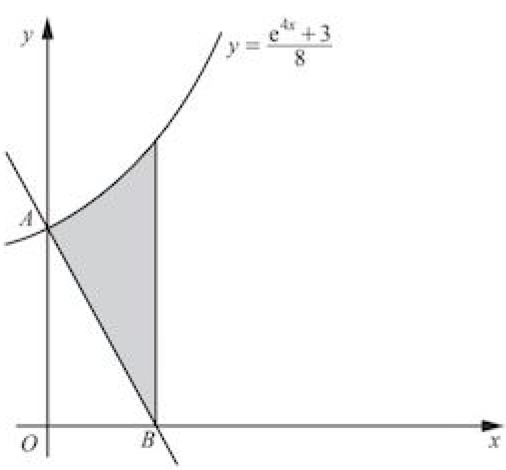
$\frac{1}{\sin\theta} = 4$

$4\sin\theta = 1$

$\sin\theta = \frac{1}{4}$

$\sin^{-1}\frac{1}{4} = 14.5$ Q1 14.5°, 194° ; Q2 166°, 346°

Est 2 :



The diagram shows the graph of the curve $\frac{e^{4x}+3}{8}$. The curve meets the y-axis at the point A. The normal to the curve A meets the x-axis at the point B. Find the area of the shaded region enclosed by the curve, the line AB and the line through B parallel to the y-axis. Give your answer in the form of $\frac{e}{a}$, where a is a constant. You must show all your working.

Est 3 :

When lg y^2 is plotted against x, a straight line is obtained passing through the points (5, 12) and (3, 20). Find y in terms of x, giving your answer in the form y= 10^{ax+b}, where a and b are integers.

Mei a6

$$\frac{20-12}{3-5} = \frac{8}{-2} = -4$$

$$y = -4x + c$$

$$12 = -20 + c$$

$$c = 32$$

$$y = -4x + 32$$

$$\log y^2 = -4x + 32$$

$$y^2 = 10^{-4x+32}$$

$$y = 10^{\frac{1}{2}(-4x+32)}$$

$$y = 10^{-2x+16}$$

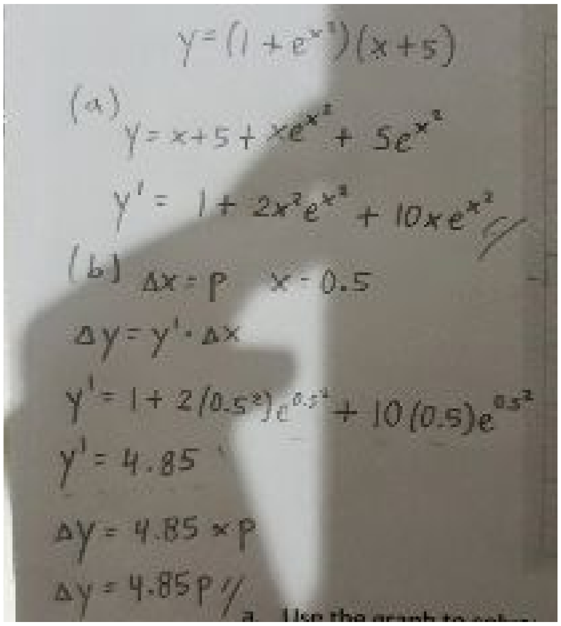
Est 4 :

Is it given that $y = (1 + e^{x^2})(x + 5)$.

a) Find $\frac{dy}{dx}$.

b) Find the approximate change in y as x increases from 0.5 to 0 5. +p, where p is small.

Gab #3



$y = (1+e^{x^2})(x+5)$

(a) $y = x+5+xe^{x^2}+5e^{x^2}$

$y' = 1+2x^2e^{x^2}+10xe^{x^2}$ //

(b) $\Delta x = p \quad x = 0.5$

$\Delta y = y' \cdot \Delta x$

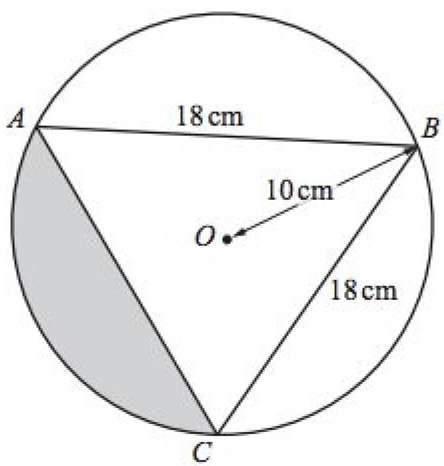
$y' = 1+2(0.5^2)e^{0.5^2}+10(0.5)e^{0.5^2}$

$y' = 4.85$

$\Delta y = 4.85 \times p$

$\Delta y = 4.85p$ //

Est 5 :



The diagram shows a circle centre O, radius 10 cm. The points A, B and C lie on the circumference of the circle such that AB = BC = 18cm.

(i) Show that angle AOB = 2 2. 4 radians correct to 2 decimal places.

(ii)Find the perimeter of the shaded region.

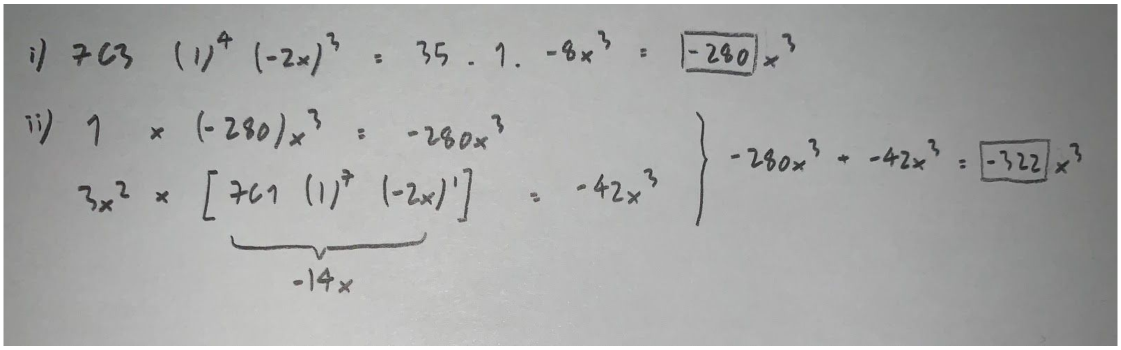
(iii) Find the area of the shaded region

Jos 1:

(i) Find the coefficient of x^3 in the expansion of $(1-2x)^7$.

(ii) Find the coefficient of x^3 in the expansion of $(1+3x^2)\,(1-2x)^7$.

Emi #2:



Jos 2:

(i) Given that $y=(12-4x)^5$, find $\frac{dy}{dx}$.

(ii) Hence find the approximate change in y as x increases from 0.5 to 0.5 $+p$, where p is small

Gab #1

(i) $y=(12-4x)^5$

$y' = 5(12-4x)^4 \cdot \ -4$

$y' = \ -20(12-4x)^4$ <u>(answer)</u>

(ii) $\Delta y = \Delta x \cdot y'$

$\Delta x = 0.5+p-0.5 \qquad x = 0.5$

$\Delta x = p$

$y' = \ -20(10)^4$

$y' = \ -200,000$

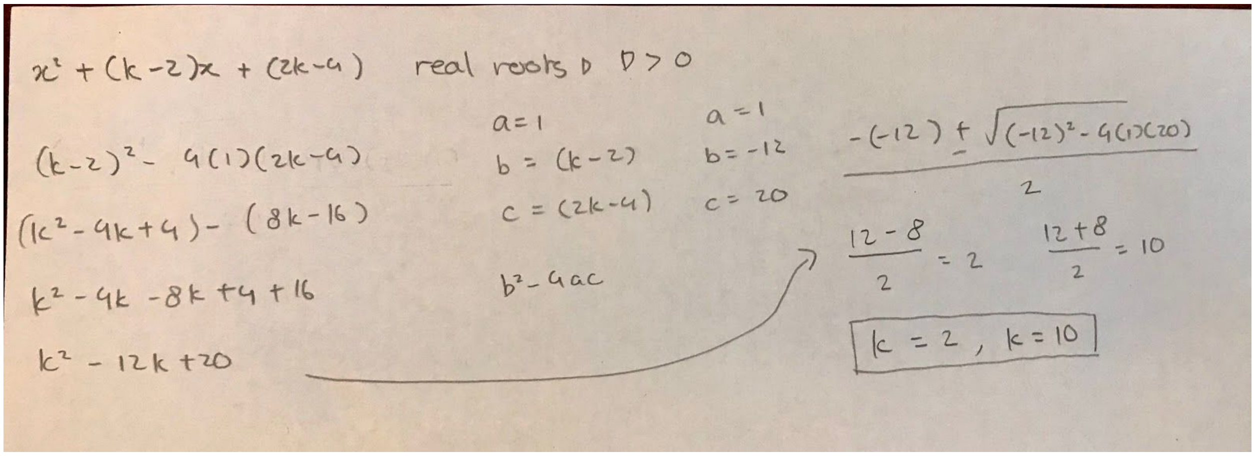
$\Delta y = \ -200,000 \cdot p$

$\Delta y = \ -200,000p$ <u>(answer)</u>

Jos 3:

Find the set of values of k for which the equation $x^2 + (k-2)x + (2k-4) = 0$ has real roots.

Cor 2:



$x^2 + (k-2)x + (2k-4)$ real roots ▷ $D > 0$

$(k-2)^2 - 4(1)(2k-4)$

$(k^2-4k+4) - (8k-16)$

$k^2 - 4k - 8k + 4 + 16$

$k^2 - 12k + 20$

$a = 1$, $b = (k-2)$, $c = (2k-4)$

$b^2 - 4ac$

$a = 1$, $b = -12$, $c = 20$

$$\frac{-(-12) \pm \sqrt{(-12)^2 - 4(1)(20)}}{2}$$

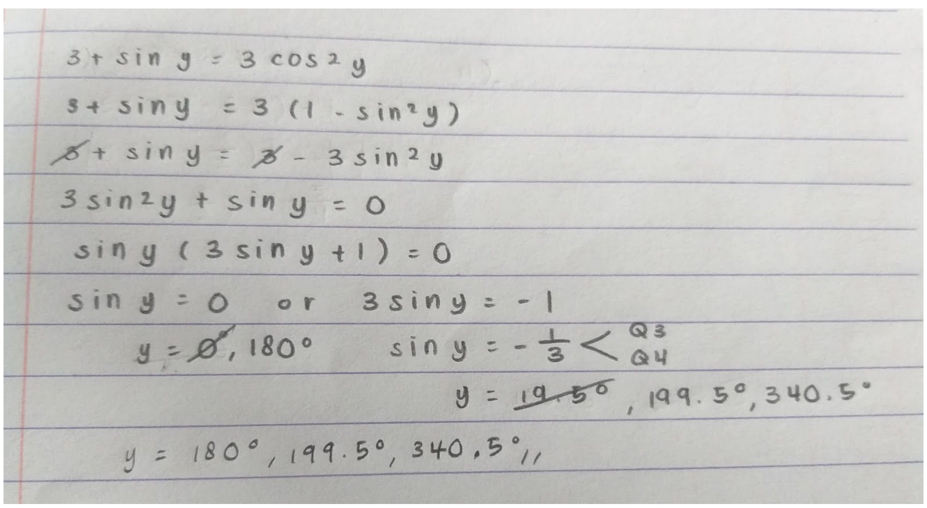
$\frac{12-8}{2} = 2$ $\frac{12+8}{2} = 10$

$k = 2, k = 10$

Jos 4:

$3 + \sin y = 3\cos^2 y$ for 0° < y < 360°,

Bri:



$3 + \sin y = 3\cos^2 y$

$3 + \sin y = 3(1 - \sin^2 y)$

$\not{3} + \sin y = \not{3} - 3\sin^2 y$

$3\sin^2 y + \sin y = 0$

$\sin y(3\sin y + 1) = 0$

$\sin y = 0$ or $3\sin y = -1$

$y = \not{0}°, 180°$ $\sin y = -\frac{1}{3}$ < Q3, Q4

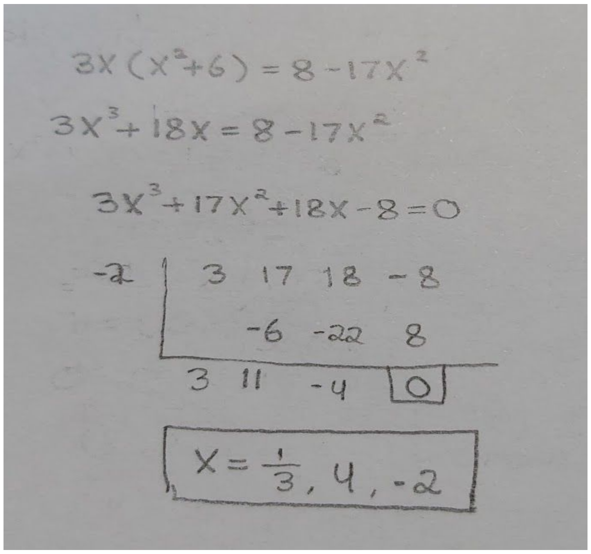
$y = \sout{19.5°}, 199.5°, 340.5°$

$y = 180°, 199.5°, 340.5°$

Jos 5:

Solve the equation $3x\,(x^2+6) = 8 - 17x^2$

Chr #4



Eze 1 :

Write down, in ascending powers of x, the first 3 terms in the expansion of $(3+2x^6)$. Give each term in its simplest form.

Jos #2

$6C0\,(3)^6 = 729$

$6C1\,(3)^5\,(2x) = 2916x$

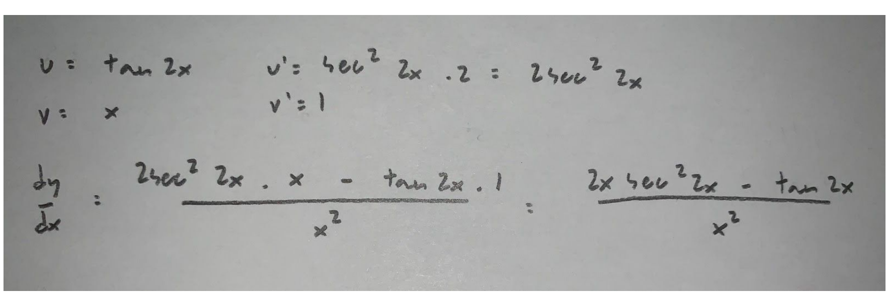
$6C2\,(3)^4\,(2x)^2 = 4860x^2$

$729 + 2916x + 4860x^2$

Eze 2 :

Given that $y = \frac{tan2x}{x}$, find $\frac{dy}{dx}$.

Emi #3:

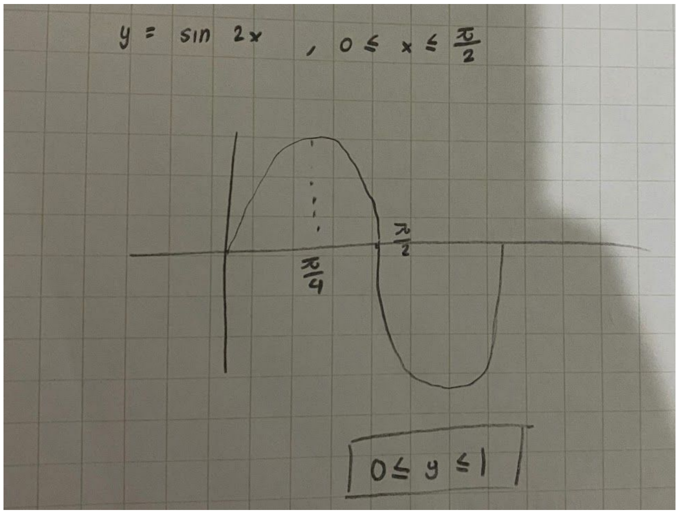


Eze 3 :

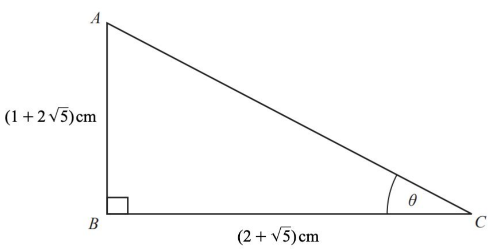
A function f is such that f(x) = $\sin 2x$ for $0 \le x \le \frac{\pi}{2}$.

(i) Write down the range of f

Est 3 :



Eze 4 :



The diagram shows triangle ABC which is right-angled at point B. The side AB = $(1 + 2\sqrt{5})$ cm and the side BC = $(2 + \sqrt{5})$ cm. Angle BCA = θ.

(i) Find $\tan\theta$ in the form a + b$\sqrt{5}$, where a and b are integers to be found.

Cor 3:

$$\tan\theta = \frac{(1+2\sqrt{5})}{(2+\sqrt{5})}$$

$$\frac{(1+2\sqrt{5})}{(2+\sqrt{5})} \times \frac{(2-\sqrt{5})}{(2-\sqrt{5})}$$

$$\frac{2+4\sqrt{5}-\sqrt{5}-2(5)}{4+2\sqrt{5}-2\sqrt{5}-5}$$

$$\frac{2+3\sqrt{5}-10}{-1}$$

$$\frac{-8+3\sqrt{5}}{-1} \rightarrow \frac{-8}{-1} + \frac{3\sqrt{5}}{-1}$$

$$8-3\sqrt{5} \qquad a+b\sqrt{5}$$

$$a=8 \,// \qquad b=-3 \,//$$

Eze 5 :

Show that $\frac{cosec\ x}{\cot x + \tan x} = \cos x$

Cor 1:

$$\frac{\frac{1}{\sin x}}{\frac{\cos x}{\sin x} + \frac{\sin x}{\cos x}}$$

$$= \frac{\frac{1}{\sin x}\cdot \sin x}{\frac{\cos x}{\sin x}\cdot \sin x + \frac{\sin x}{\cos x}\cdot \sin x}$$

$$= \frac{1}{\cos x + \frac{\sin^2 x}{\cos x}}$$

$$\frac{1\cdot \cos x}{\cos x \cdot \cos x + \frac{\sin^2 x}{\cos x}\cdot \cos x}$$

$$\frac{\cos x}{\cos^2 x + \sin^2 x}$$

$$\frac{\cos x}{1} = \boxed{\cos x}$$

Cor 1:

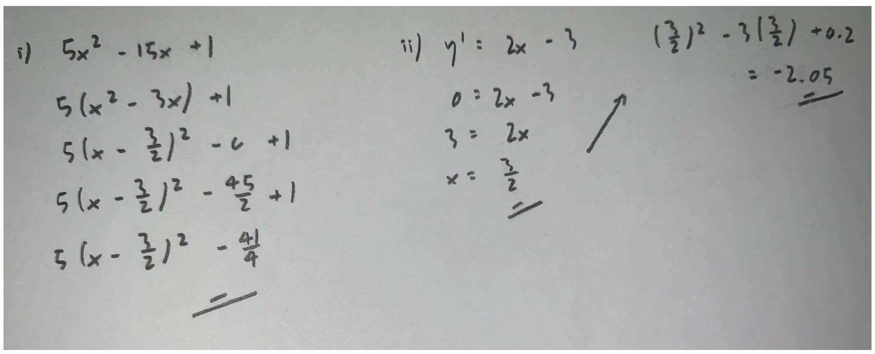
Solve $lg(x^2 - 3) > 1$

Cor 2:

(i) Express $5x^2 - 15x + 1$ in the form $p(x+q)^2 + r$

(ii) Hence state the least value of $x^2 - 3x + 0.2$ and the value of x at which this occurs.

Emi #4:



i) $5x^2 - 15x + 1$

$5(x^2 - 3x) + 1$

$5(x - \frac{3}{2})^2 - 6 + 1$

$5(x - \frac{3}{2})^2 - \frac{45}{2} + 1$

$5(x - \frac{3}{2})^2 - \frac{41}{4}$

ii) $y' = 2x - 3$

$0 = 2x - 3$

$3 = 2x$

$x = \frac{3}{2}$

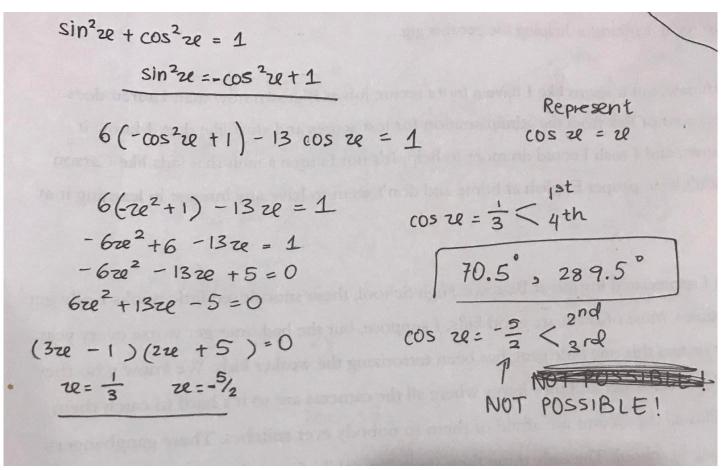
$(\frac{3}{2})^2 - 3(\frac{3}{2}) + 0.2$

$= -2.05$

Cor 3:

Solve $6sin^2x - 13cosx = 1$ for 0° $\leq x \leq$ 360°

Nat a8:



$\sin^2 x + \cos^2 x = 1$

$\sin^2 x = -\cos^2 x + 1$

$6(-\cos^2 x + 1) - 13\cos x = 1$

Represent $\cos x = x$

$6(-x^2 + 1) - 13x = 1$

$-6x^2 + 6 - 13x = 1$

$-6x^2 - 13x + 5 = 0$

$6x^2 + 13x - 5 = 0$

$(3x - 1)(2x + 5) = 0$

$x = \frac{1}{3}$ $\quad x = -\frac{5}{2}$

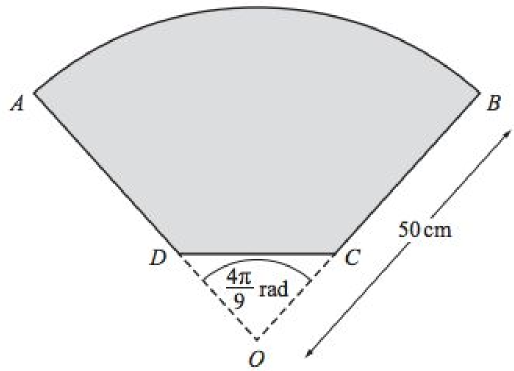
$\cos x = \frac{1}{3}$ < 1st, 4th

70.5°, 289.5°

$\cos x = -\frac{5}{2}$ < 2nd, 3rd

NOT POSSIBLE!

Cor 4:



The diagram shows a company logo, ABCD. The logo is part of a sector, AOB, of a circle, centre O and radius 50cm. The points C and D lie on OB and OA respectively. The lengths AD and BC are equal and AD : AO is 7 : 10. The angle AOB is $\frac{4\pi}{9}$ radians.

(i) Find the perimeter of ABCD.

(ii) Find the area of ABCD

Chr #5

i.) $\frac{7}{10} \times 50 = 35$

AD = 35 cm

BC = 35 cm

$50 \times \frac{4\pi}{9}$

$= 50 \times 1.396$

$= \frac{200\pi}{9}$

$AB = \frac{200\pi}{9}$

DO = 15 cm

$\frac{4\pi}{9} \div 2 = \frac{2}{9}\pi$

15, $\frac{2}{9}\pi$, ?

$\sin \frac{2}{9}\pi = \frac{x}{15}$

$= 9.64$

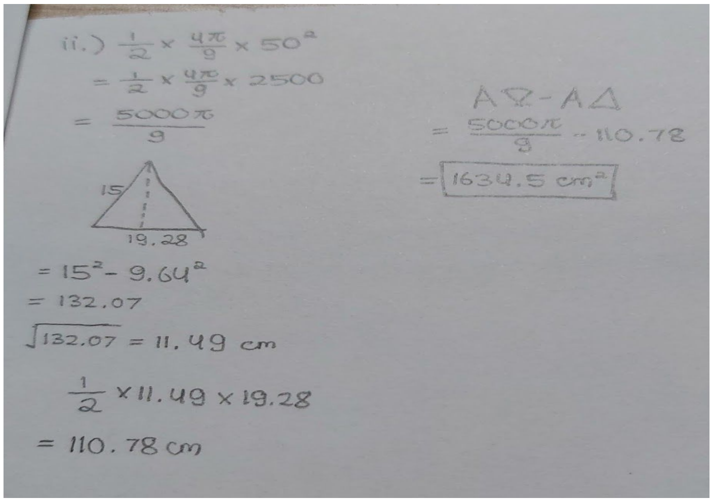
9.64×2

$= 19.28$ cm

DC = 19.28 cm

$\frac{200\pi}{9} + 35 + 35 + 19.28$

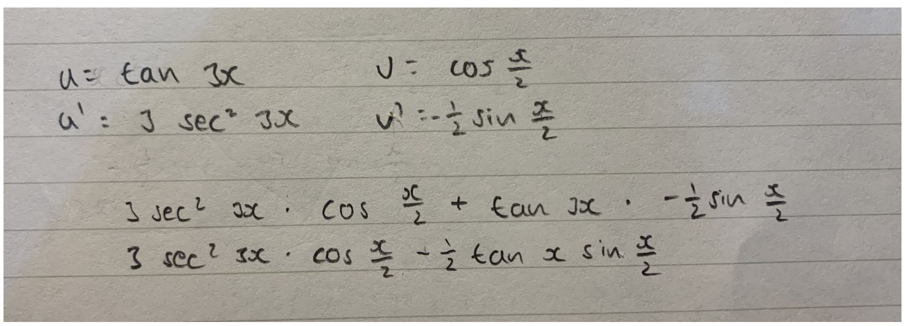
= **159.1 cm**



Cor 5:

Differentiate $tan3x\ cos\frac{x}{2}$ with respect to x.

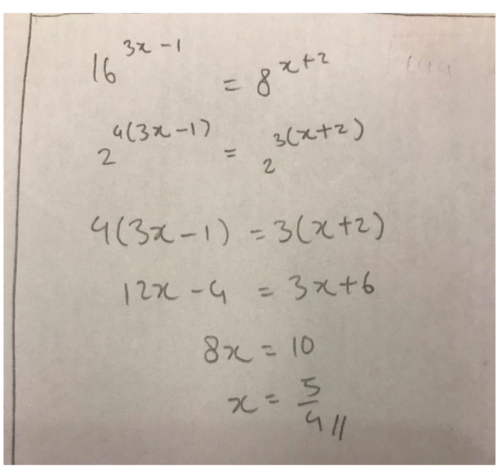
Eze #5



Chr 1:

Solve the equation $16^{3x-1} = 8^{x+2}$

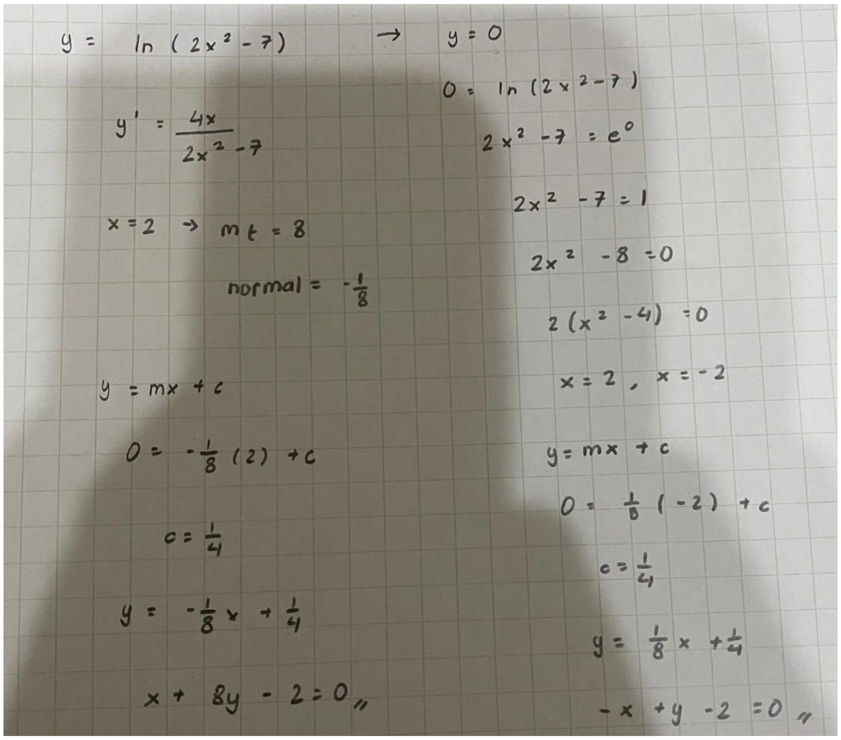
Cor 5:



Chr 2:

Find the equation of the normal to the curve $y = ln(2x^2 - 7)$ at the point where the curve crosses the positive x-axis. Give your answer in the form ax + by + c = 0 , where a, b and c are integers.

Est 2:



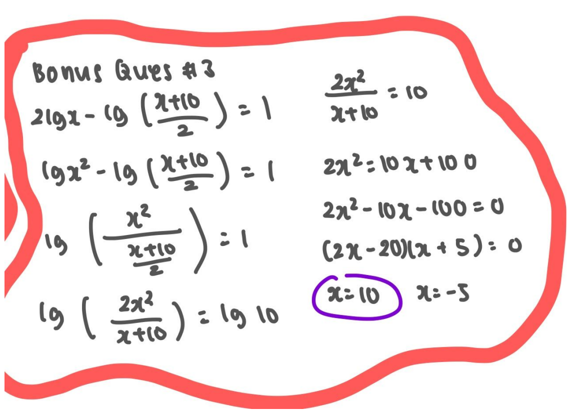
Chr 3:

Find the values of x for which $(x - 4)(x + 2) > 7$.

Chr 4:

Solve the equation $2lgx - lg(\frac{x+10}{2}) = 1$

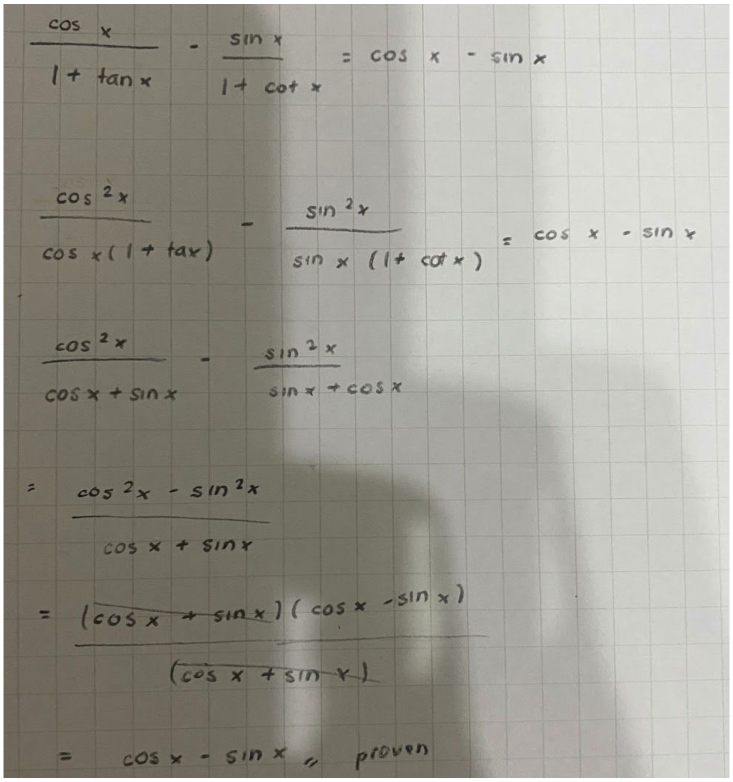
Kay 3:



Chr 5:

Prove that $\frac{cosx}{1+tanx} - \frac{sinx}{1+cotx} = cosx - sinx$

Est 1 :



$$\frac{\cos x}{1+\tan x} - \frac{\sin x}{1+\cot x} = \cos x - \sin x$$

$$\frac{\cos^2 x}{\cos x(1+\tan x)} - \frac{\sin^2 x}{\sin x(1+\cot x)} = \cos x - \sin x$$

$$\frac{\cos^2 x}{\cos x+\sin x} - \frac{\sin^2 x}{\sin x+\cos x}$$

$$= \frac{\cos^2 x - \sin^2 x}{\cos x+\sin x}$$

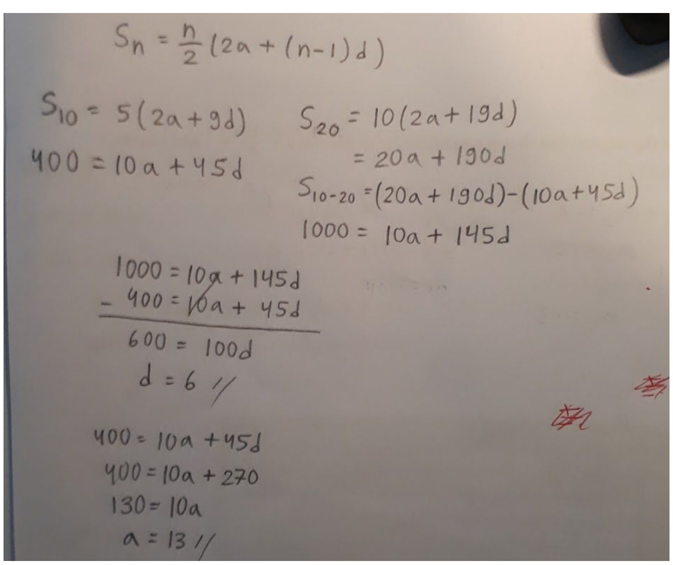
$$= \frac{(\cos x+\sin x)(\cos x-\sin x)}{(\cos x+\sin x)}$$

$$= \cos x - \sin x \text{ // proven}$$

Bri 6:

In an arithmetic progression, the sum of the first ten terms is 400 and the sum of the next ten terms is 1000. Find the common difference and the first term

Gab #6



$$S_n = \frac{n}{2}(2a+(n-1)d)$$

$S_{10} = 5(2a+9d)$

$400 = 10a + 45d$

$S_{20} = 10(2a+19d)$

$= 20a + 190d$

$S_{10-20} = (20a+190d) - (10a+45d)$

$1000 = 10a + 145d$

$1000 = 10a + 145d$

$- 400 = 10a + 45d$

$600 = 100d$

$d = 6$ //

$400 = 10a + 45d$

$400 = 10a + 270$

$130 = 10a$

$a = 13$ //

Bri 7:

An arithmetic series has seven terms. The first term is 5 and the last term is 53. Find the sum of the series.

Kay 7:

7. arithmetic series = 7 terms

$U_n = U_1 + (n-1)d$

$U_7 = 5 + (6)d$

$5 + 6d = 53$

$6d = 48 \quad d = 8$

$S_n = \frac{7}{2}(2(5) + 6d)$

$= \frac{7}{2}(10 + 48)$

$= \underline{203}$

Bri 8:

Five consecutive terms of an arithmetic sequence have a sum of 40. The product of the first, middle and last terms is 224. Find the terms of the sequence.

Mei a7

$a_n + a_{n+1} + a_{n+2} + a_{n+3} + a_{n+4} = 40$

$a_n + (a_n + d) + (a_n + 2d) + (a_n + 3d) + (a_n + 4d) = 40$

$5a_n + 10d = 40$

$a_n + 2d = 8$

$a_n = 8 - 2d$

$a_n \times a_{n+2} \times a_{n+4} = 224$

$a_n \times (a_n + 2d) \times (a_n + 4d) = 224$

subs $a_n = 8 - 2d$

$(8 - 2d)(8 - 2d + 2d)(8 - 2d + 4d) = 224$

$8(8 - 2d)(8 + 2d) = 224$

$8^2 - (2d)^2 = \frac{224}{8}$

$-4d^2 = -36$

$d^2 = 9$

$d = 3$

$a_n = 8 - 2(3)$

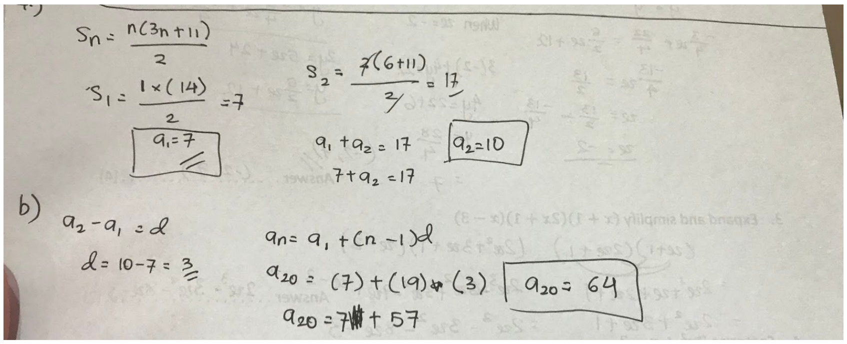
$= 2$

$\therefore 2, 5, 8, 11, 14, 17, 20, 23, \ldots$

Bri 9:

The sum of the first n terms of an arithmetic sequence is $n(3n+11)/2$. Find its first two terms and find the twentieth term of the sequence.

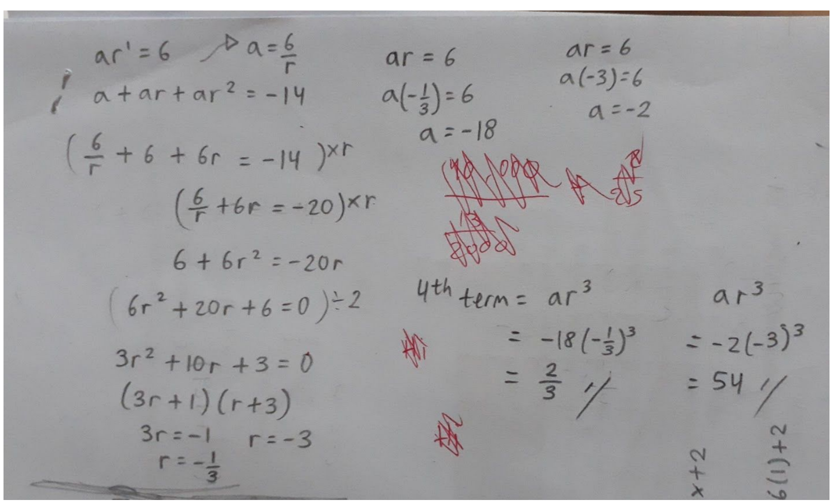
Nat #a9



Bri 10:

A geometric series has a second term 6. The sum of its first three terms is -14. Find its fourth term.

Gab #7



Gab 6

A company, which is making 200 mobile phones each week, plans to increase its production.

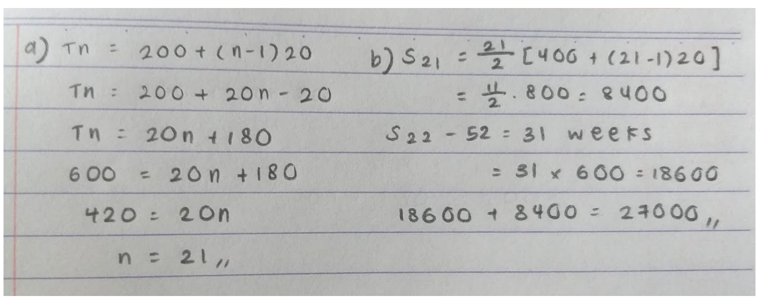
The number of mobile phones produced is to be increased by 20 each week from 200 in week 1, to 220 in week 2, to 240 in week 3 and so on, until it is producing 600 in week N.

(a) Find the value of N.

The company then plans to continue to make 600 mobile phones each week.

(b) Find the total number of mobile phones that will be made in the first 52 weeks starting from and including week 1.

Bri a6:



a) $Tn = 200 + (n-1)20$

$Tn = 200 + 20n - 20$

$Tn = 20n + 180$

$600 = 20n + 180$

$420 = 20n$

$n = 21$ //

b) $S_{21} = \frac{21}{2}[400 + (21-1)20]$

$= \frac{u}{2} . 800 = 8400$

$S_{22} - 52 = 31$ weeks

$= 31 \times 600 = 18600$

$18600 + 8400 = 27000$ //

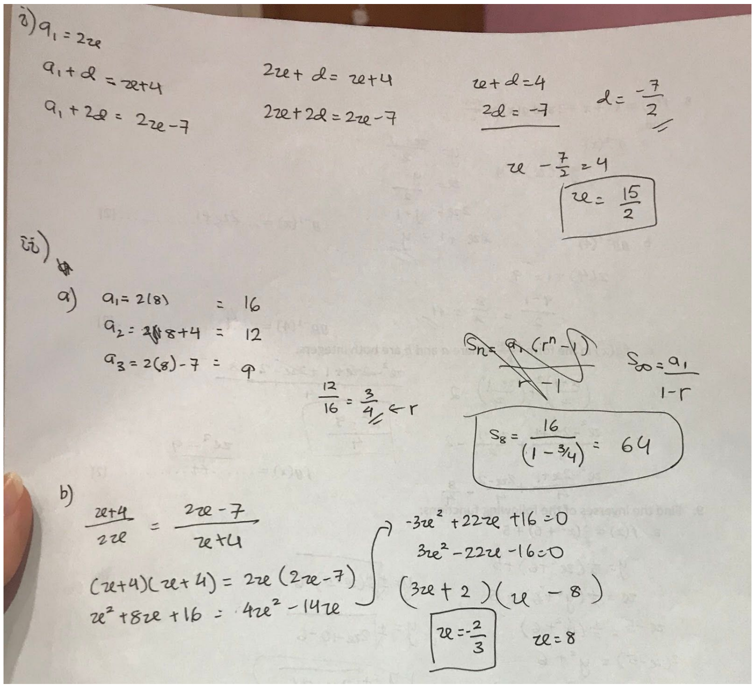
Gab 7

(i) The first three terms of an arithmetic progression are $2x,\ x+4$ and $2x-7$ respectively. Find the value of x.

(ii) The first three terms of another sequence are also $2x,\ x+4$ and $2x-7$ respectively.

- (a) Verify that when $x = 8$ the terms form a geometric progression and find the sum to infinity in this case.
- (b) Find the other possible value of x that also gives a geometric progression.

Nat #a10



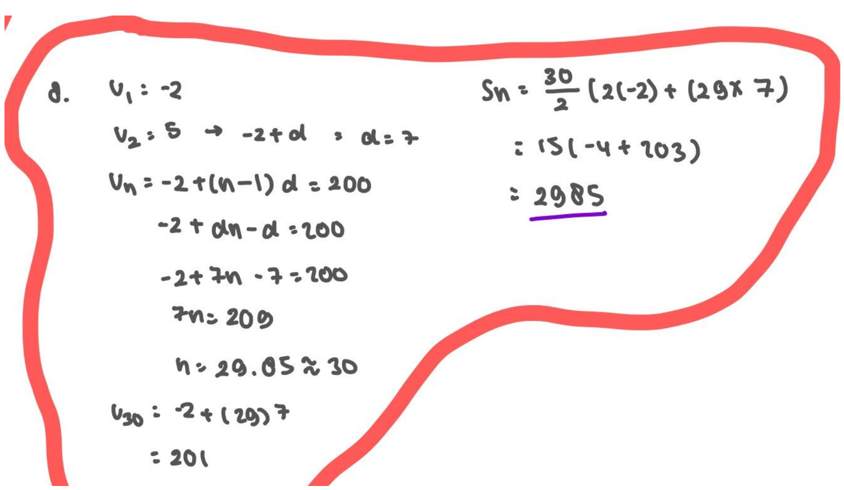
Gab 8

The sum of the first n terms, $S_{n,}$ of a particular arithmetic progression is given by $S_n = \frac{n}{12}(4n + 5)$. Find an expression for the nth term.

Gab 9

The first two terms in an arithmetic progression are -2 and 5. The last term in the progression is the only number in the progression that is greater than 200. Find the sum of all the terms in the progression.

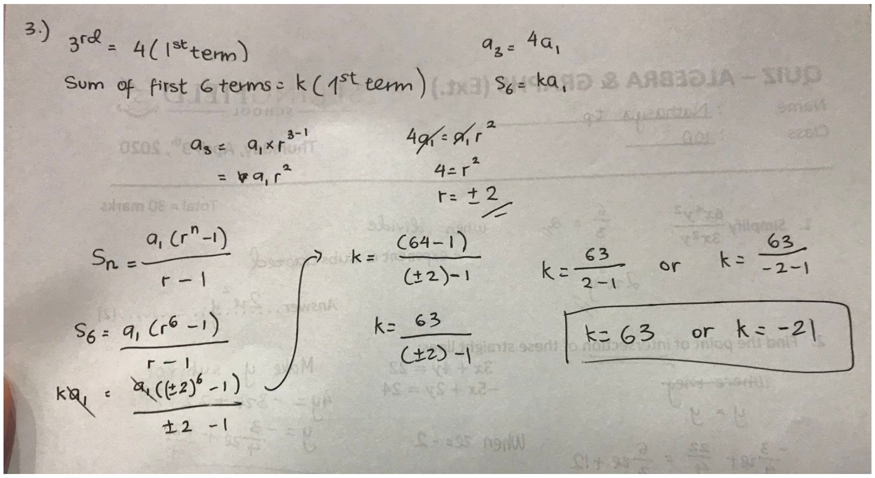
Kay #8



Gab 10

The third term of a geometric progression is nine times the first term. The sum of the first four terms is k times the first term. Find the possible values of k.

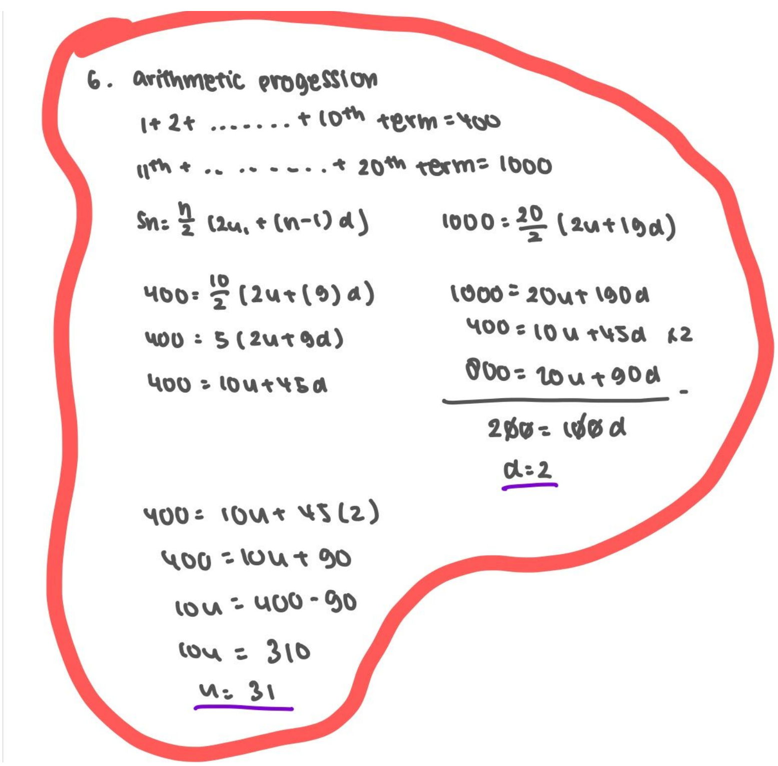
Nat #a8



Eze 6

In an arithmetic progression the sum of the first ten terms is 400 and the sum of the next ten terms is 1000. Find the common difference and the first term.

Kay #6:



Eze 7

A geometric progression has first term a, common ratio r and sum to infinity 6. A second geometric progression has first term 2a, common ratio r^2 and sum to infinity 7. Find the values of a and r.

Eze 8

A sequence $u_1, u_2, u_3,$ …. Is defined by

$u_1 = 7 \; and \; u_{n+1} = u_n + 4$ for $n \geq 1$.

a. Show that $u_{17} = 71$

Mei a8

$u_{n+1} = u_n + 4$

$u_{1+1} = u_1 + 4$

$u_2 = 11$

$11 - 7 = 4$ ← diff.

$u_n = 7 + 4(n-1)$

$u_{17} = 7 + 4(16)$

$= 71$ shown!

Eze 9

A sequence $u_1, u_2, u_3,$ …. Is defined by

$u_1 = 4 \; and \; u_{n+1} = \frac{2}{u_n}$ for $n \geq 1$.

a. Write down the values of $u_2 \; and \; u_3.$

Mei a9

$u_{n+1} = \frac{2}{u_n}$

$u_{(1)+1} = \frac{2}{u_{(1)}}$

$u_2 = \frac{2}{4}$

$= \frac{1}{2}$

$u_{(2)+1} = \frac{2}{u_2}$

$u_3 = \frac{2}{\frac{1}{2}}$

$= 4$

Eze 10

The first term of an arithmetic sequence is 30 and the common difference is -1.5.

a. Find the value of the 25^{th} term

The r^{th} term of the sequence is 0

b. Find the value of r

Gab #8

a. $U_n = a + (n-1)d$

$a = 30 \quad d = \ -1.5$

$U_{25} = 30 + (24) \cdot \ -1.5$

$U_{25} = \ -6$ <u>(answer)</u>

b. $U_n = a + (n-1)d$

$0 = a + (n-1)d$

$0 = 30 + (n-1) \cdot \ -1.5$

$0 = 30 - 1.5n + 1.5$

$0 = 31.5 - 1.5n$

$1.5n = 31.5$

$n = 21$ <u>(answer)</u>

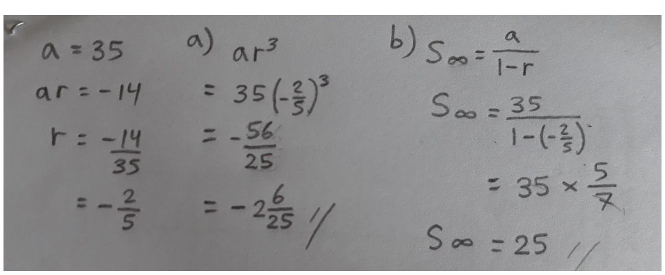
Kay #6

The first term of a geometric progression is 35 and the second term is -14

a. Find the fourth term

b. Find the sum to infinity

Gab #9



Kay #7

A geometric progression has first term *a* and a common ratio *r*. The sum of the first three terms is 62 and the sum to infinity is 62.5. Find the value of *a* and the value of *r.*

Kay #8

Expand $(3+x)^4$. Use your answer to express $(3+\sqrt{5})^4$ in the form $a+b\sqrt{5}$.

Cho #6

$x^4 + 12x^3 + 54x^2 + 108x + 81$

So,

$25 + 12(\sqrt{5})^3 + 270 + 108\sqrt{5} + 81$

$25 + 60\sqrt{5} + 270 + 108\sqrt{5} + 81$

$376 + 168\sqrt{5}$

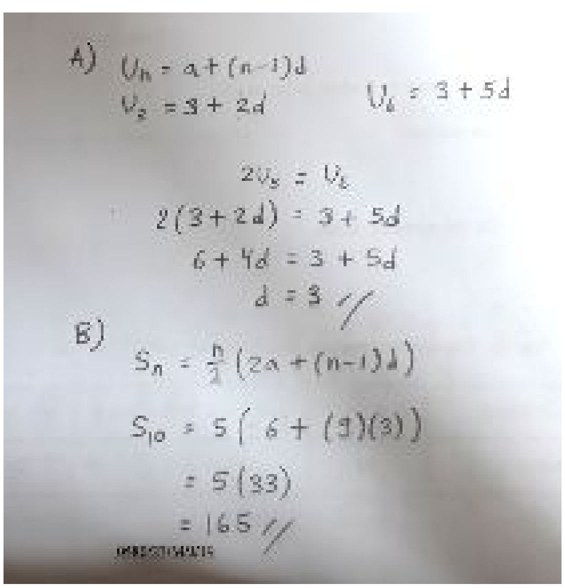
Kay #9

The sixth term of arithmetic progression is twice the third term, and the first term is 3. The sequence has ten terms

A) Find the common difference

B) Find the sum of all the terms in the progression

Gab #10



A) $U_n = a + (n-1)d$

$U_3 = 3 + 2d$ $\quad$ $U_6 = 3 + 5d$

$2U_3 = U_6$

$2(3+2d) = 3 + 5d$

$6 + 4d = 3 + 5d$

$d = 3$ //

B) $S_n = \frac{n}{2}(2a + (n-1)d)$

$S_{10} = 5(6 + (9)(3))$

$= 5(33)$

$= 165$ //

Rai #6

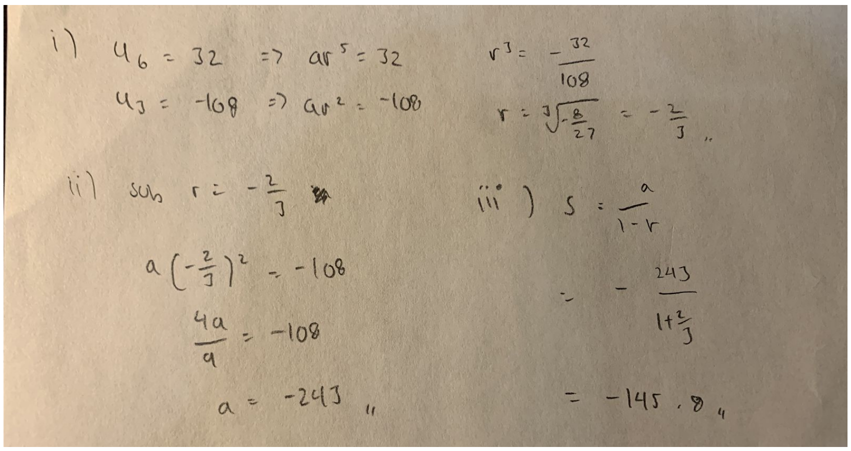
The third term of a geometric progression is -108 and the sixth term is 32. Find

a) The common ratio

b) The first term

c) The sum to infinity

Eze 6



i) $u_6 = 32 \Rightarrow ar^5 = 32$

$u_3 = -108 \Rightarrow ar^2 = -108$

$r^3 = -\frac{32}{108}$

$r = \sqrt[3]{-\frac{8}{27}} = -\frac{2}{3}$

ii) sub $r = -\frac{2}{3}$

$a\left(-\frac{2}{3}\right)^2 = -108$

$\frac{4a}{9} = -108$

$a = -243$

iii) $S = \frac{a}{1-r}$

$= -\frac{243}{1+\frac{2}{3}}$

$= -145.8$

Rai #7

The second and third terms of a geometric series are 192 and 144 respectively

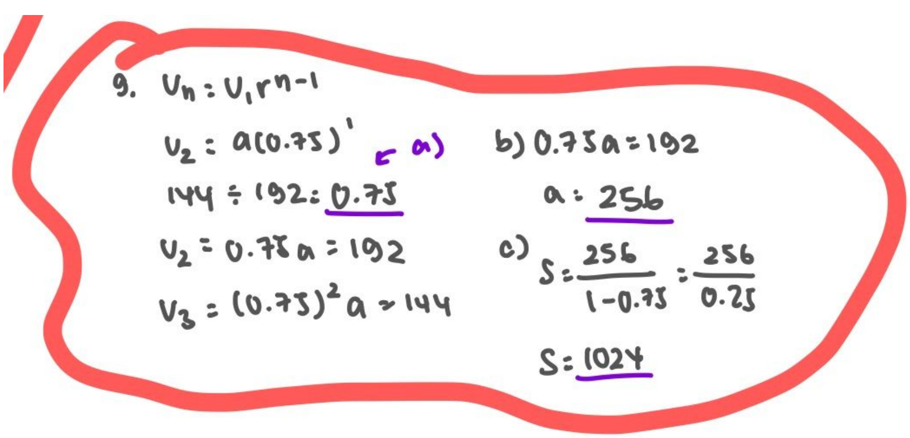
For this series, find

a) The common ratio

b) The first term

c) The sum to infinity

Kay #9



9. $U_n = U_1 r^{n-1}$

$U_2 = a(0.75)^1$

a) $144 \div 192 = 0.75$

$U_2 = 0.75a = 192$

$U_3 = (0.75)^2 a = 144$

b) $0.75a = 192$

$a = 256$

c) $S = \frac{256}{1-0.75} = \frac{256}{0.25}$

$S = 1024$

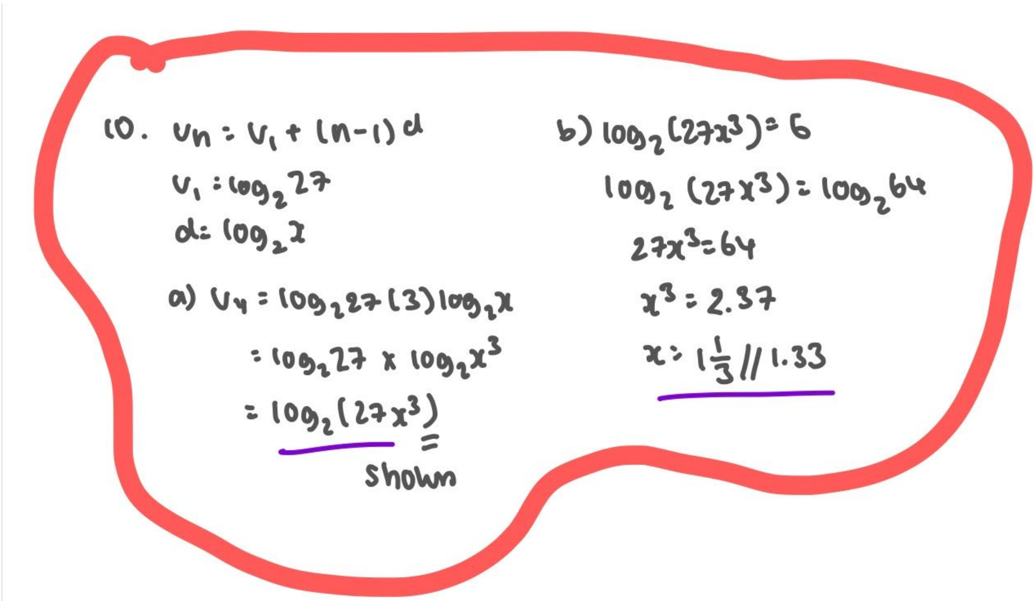
Rai #8

An arithmetic progression has first term $log_2 27$ and a common difference $log_2 x$

a) Show that the fourth term can be written as $log_2(27x^3)$

b) Given that the fourth term is 6, find the exact value of x

Kay #10



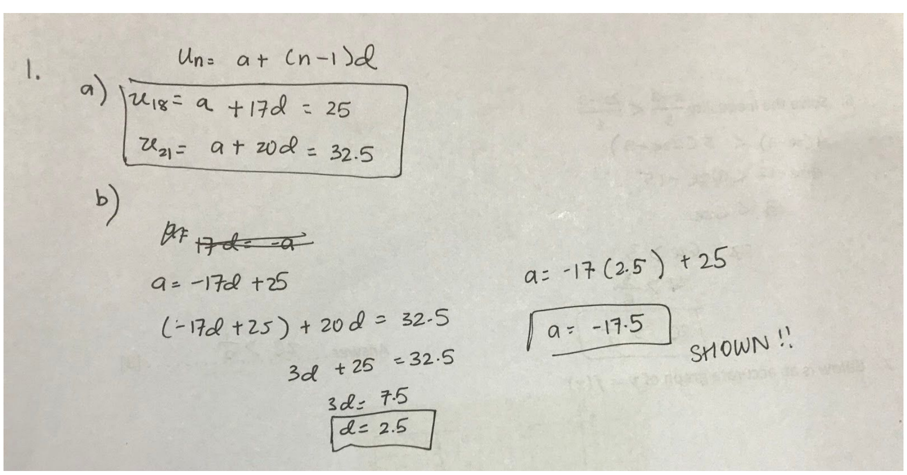
Mei #6

The first term of an arithmetic series is *a* and the common difference is *d*. The 18th term of the series is 25 and the 21st term of the series is $32\frac{1}{2}$.

(a) Use this information to write down two equations for *a* and *d*.

(b) Show that *a* = –17.5 and find the value of *d*.

Nat #a6:



Mei #7

The first three and last terms of an arithmetic sequence are 7,13,19,...,1357

(a) Find the common difference.

(b) Find the number of terms in the sequence.

(c) What is the sum of the sequence.

Mei #8

An arithmetic sequence is given by 6, 13, 20, …

(a) Write down the value of the common difference, d.

(b) Find U_{100};

(c) Find S_{100};

(d) Given that $U_n = 1434$, find the value of n.

Mei #9

The first term of an infinite geometric sequence is 10. The sum of the infinite sequence is 500.

(a) Find the common ratio.

(b) Find the sum of the first 9 terms.

(c) Find the least value of n for which $S_n > 250$.

Mei #10

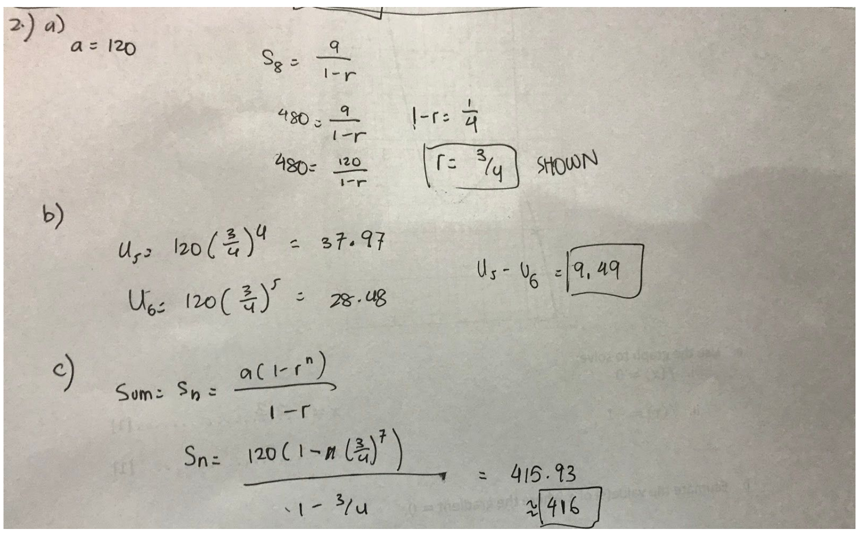
The first term of a geometric series is 120. The sum to infinity of the series is 480.

(a) Show that the common ratio, *r*, is $\frac{3}{4}$.

(b) Find,to 2 decimal places, the difference between the 5th and 6th term.

(c) Calculate the sum of the first 7 terms.

Nat #a7:



Nat #6

(a) Find the sum to infinity of the Geometric progression with first term 3 and common ratio 1 .2

(b) The sum to infinity of a Geometric progression is four times the first term. Find the common ratio.

(c) The sum to infinity of a Geometric progression is twice the sum of the first two terms. Find possible values of the common ratio.

Nat #7

Find the sum of the geometric series:

$8-4+2-1+...$

where there are 5 terms in the series.

Nat #8

In the year 2000, a shop sold 150 computers. Each year the shop sold 10 more computers than the year before, so that the shop sold 160 computers in 2001, 170 computers in 2002, and so on forming arithmetic sequence

a) Show that the shop sold 220 computers in 2007
b) Calculate the total number of computers the shop sold from 2000 to 2013 inclusive

Nat #9

Given that $2x$, 5 and $6 - x$ are the first three terms in an arithmetic progression, what is d?

Nat #10

Consider a geometric progression whose first three terms are 12, −6 and 3. Notice that $r = -_1$. Find both S_8 and S_∞.