Candidate 1

QUESTION NUMBER

1.(a)

$A(-5,-12)$ $B(11,-8)$ $C(-3,6)$

$M_{PAC} = \left(\frac{x_1+x_2}{2}, \frac{y_1+y_2}{2}\right)$

$= \left(\frac{-5+(-3)}{2}, \frac{-12+6}{2}\right)$

$= \left(\frac{-8}{2}, \frac{-6}{2}\right)$

$P = (-4,-3)$

$m_{BP} = \frac{y_2-y_1}{x_2-x_1} = \frac{-3-(-8)}{-4-11} = \frac{5}{-15} = -\frac{1}{3}$

$y - b = m(x-a)$

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

$3(y+3) = -1(x+4)$

$3y+9 = -x-4$

$3y = -x-13$

1.(b)

$m_{CB} = \frac{y_2-y_1}{x_2-x_1} = \frac{6-(-8)}{-3-11} = \frac{14}{-14} = -1$

$y - b = m(x-a)$

$y-(-14) = -1(x-(-5))$

$y+12 = -1(x+5)$

$y+12 = -x-5$

$y = -x-17$

1.(c)

$y = y$

$-x - 17 = -\frac{x}{3} - \frac{8}{3}$

$3(-x-17) = -x - 8$

$-3x - 51 = -x - 8$

$3x + 51 = x + 8$

$2x = -43$

$x = -\frac{43}{2}$

$3y = -x - 8$

$y = -\frac{x}{3} - \frac{8}{3}$

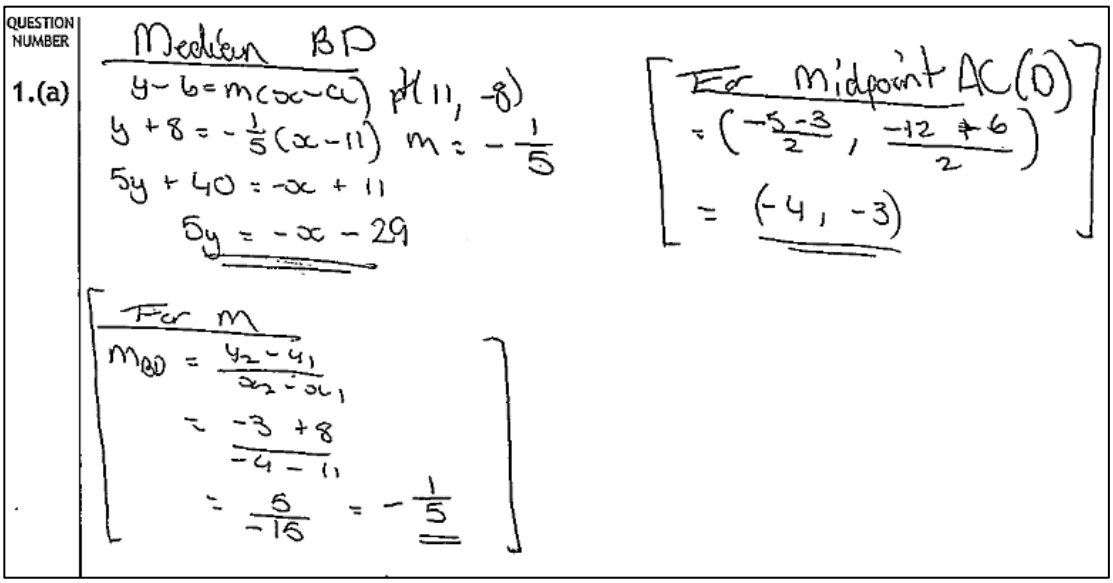
$x = -\frac{43}{2}$

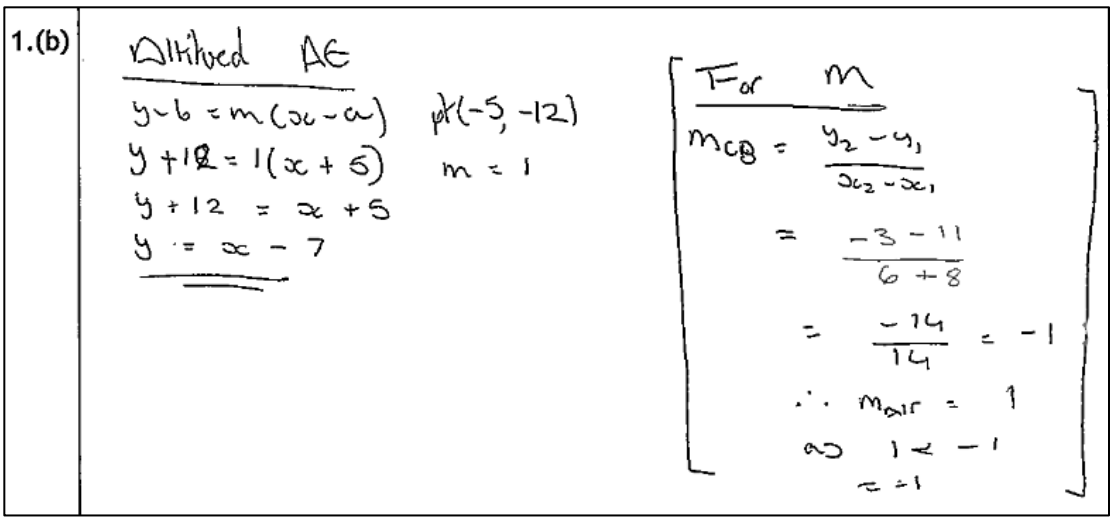
$y = -(-\frac{43}{2}) - 17$

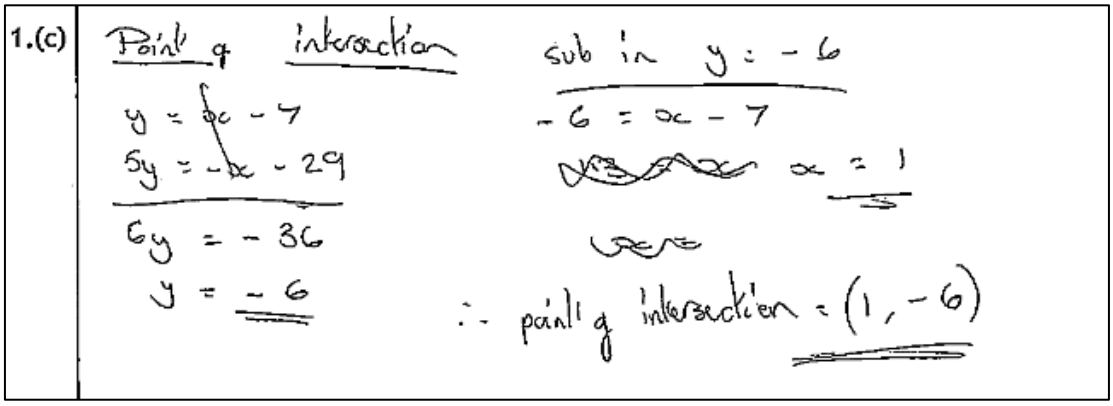
$y = \frac{9}{2}$

$(-\frac{43}{2}, \frac{9}{2})$

Candidate 2


QUESTION NUMBER
1.(a)
Median BD
y − 6 = m(x − a) pt(11, −8)
y + 8 = −1/5(x − 11) m = −1/5
5y + 40 = −x + 11
5y = −x − 29
For midpoint AC(D)
= (−5−3/2, −12+6/2)
= (−4, −3)
For m
m_BD = y2 − y1 / x2 − x1
= −3 + 8 / −4 − 11
= 5/−15 = −1/5


1.(b)
Altitude AE
y − b = m(x − a) pt(−5, −12)
y + 12 = 1(x + 5) m = 1
y + 12 = x + 5
y = x − 7
For m
m_CB = y2 − y1 / x2 − x1
= −3 − 11 / 6 + 8
= −14/14 = −1
∴ m_AE = 1
as 1 × −1 = −1


1.(c)
Point of interaction
y = x − 7
5y = −x − 29
6y = −36
y = −6
sub in y = −6
−6 = x − 7
x = 1
∴ point of interaction = (1, −6)

Candidate 3

$$\int (6\sqrt{x} - 4x^{-3} + 5)\,dx$$

$$\Rightarrow \int (6x^{\frac{1}{2}} - 4x^{-3} + 5)\,dx$$

$$= (4x^{\frac{3}{2}} + 8x^{-2} + 5x)$$

Candidate 4

$$\int \left(6\sqrt{x} - 4x^{-3} + 5\right) dx$$

$$\int = \left(6x^{1/2} - 4x^{-3} + 5\right) dx$$

$$\int = \left(\frac{6x^{3/2}}{3/2} - \frac{4x^{-2}}{-2} + 5x + c\right)$$

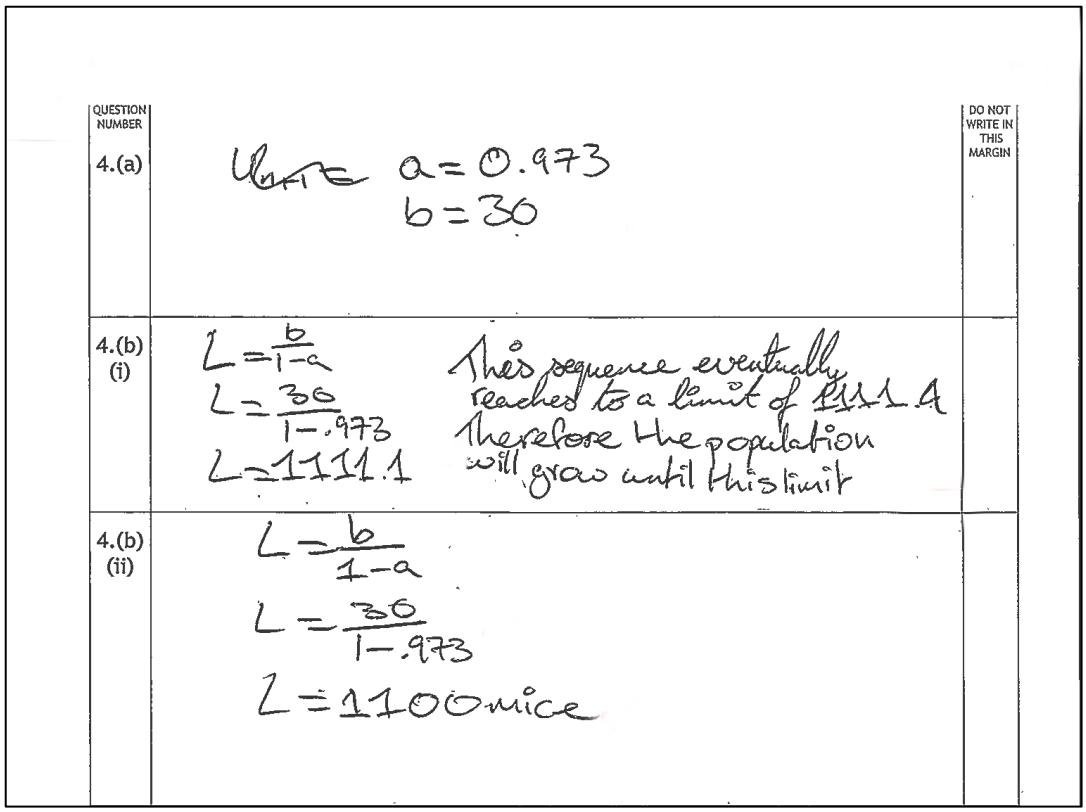
$$= \frac{6\sqrt{x^3}}{3/2} - \frac{2}{4x^2} + 5x + c$$

$$= \frac{12\sqrt{x^3}}{3} - \frac{1}{2x^2} + 5x + c$$

Candidate 5

3.(b) $\overrightarrow{EF} = -r + p + \frac{2}{3}q$

Candidate 6



QUESTION NUMBER		DO NOT WRITE IN THIS MARGIN
4.(a)	Write $a = 0.973$ $b = 30$	
4.(b) (i)	$L = \frac{b}{1-a}$ $L = \frac{30}{1-.973}$ $L = 1111.1$ This sequence eventually reached to a limit of 1111.1 Therefore the population will grow until this limit	
4.(b) (ii)	$L = \frac{b}{1-a}$ $L = \frac{30}{1-.973}$ $L = 1100$ mice	

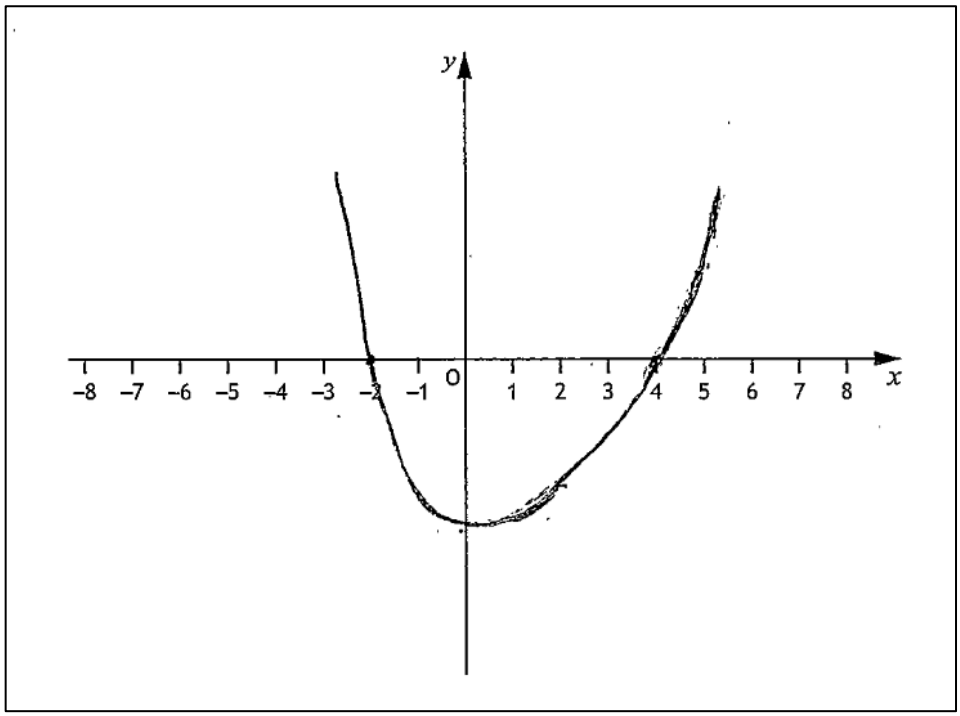
Candidate 7

QUESTION NUMBER		DO NOT WRITE IN THIS MARGIN
4.(a)	$b=30$ $a=0.973$	
4.(b) (i)	As there will be a Limit as $\|0.973\| < 1$	
4.(b) (ii)	$u_{n+1} = 0.973 \times 100 + 30$ $= 127.3$ 1100 $L = \frac{b}{1-a}$ $= \frac{30}{1-0.973}$	

Candidate 8

QUESTION NUMBER	
4.(a)	$u_{n+1} = au_n + b$ ~~$a = 1.27$~~ $a = 0.27$ ~~$b = 30$~~ $b = 30$
4.(b) (i)	~~[illegible].~~ Will stabalise as there is a limit as $-1 < m < 1$
4.(b) (ii)	$L = \frac{c}{1-m}$ $= \frac{30}{1-0.27}$ $= 41.09$ $= 41.1$

Candidate 9



Candidate 10

QUESTION NUMBER

DO NOT WRITE IN THIS MARGIN

6.(a)

$2\cos x - 3\sin x = k\cos(x + a)$

$= k(\cos x \cos a - \sin x \sin a)$

$= k\cos a \cos x - k\sin a \sin x$

$k\sin a = -3$

$k\cos a = 2$

$k = \sqrt{-3^2 + 2^2}$

$= \sqrt{9+4}$

$k = \sqrt{13}$

$\tan a = \frac{k\sin a}{k\cos a}$

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

$a = \tan^{-1}\frac{3}{2}$

$= 56.31$

$a = 303.69$

$2\cos x - 3\sin x = \sqrt{13}\cos(x + 303.69)$

6.(b)

$\sqrt{13}\cos(x + 303.69) = 3$

$\cos(x + 303.69) = \frac{3}{\sqrt{13}}$

$\cos x + \cos 303.69 = \frac{3}{\sqrt{13}}$

$\cos x = \frac{3}{\sqrt{13}} - 0.556$

$= 0.2196$

$x = \cos^{-1} 0.2196$

$= 77.3$

Candidate 11

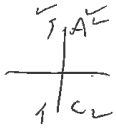
QUESTION NUMBER 6.(a)

DO NOT WRITE IN THIS MARGIN

$2\cos x - 3\sin x = k\cos(x+a)$

$= k\cos x\cos a - k\sin x\sin a$

(2 under $\cos a$, 3 under $\sin a$)



$\cos a = 2$

$\sin a = 3$

$\tan a = \frac{3}{2}$

$a = \tan^{-1}(3/2)$

$a = 56.3$

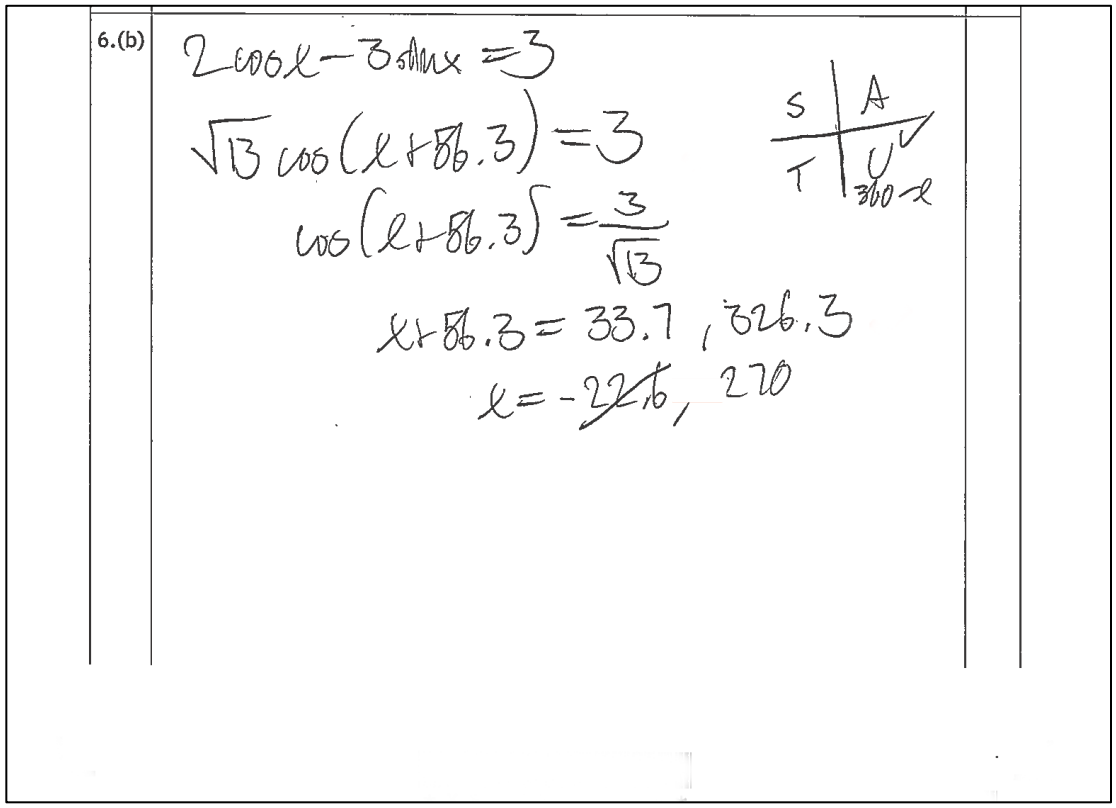
$k = \sqrt{2^2 + 3^2}$

$= \sqrt{4+9}$

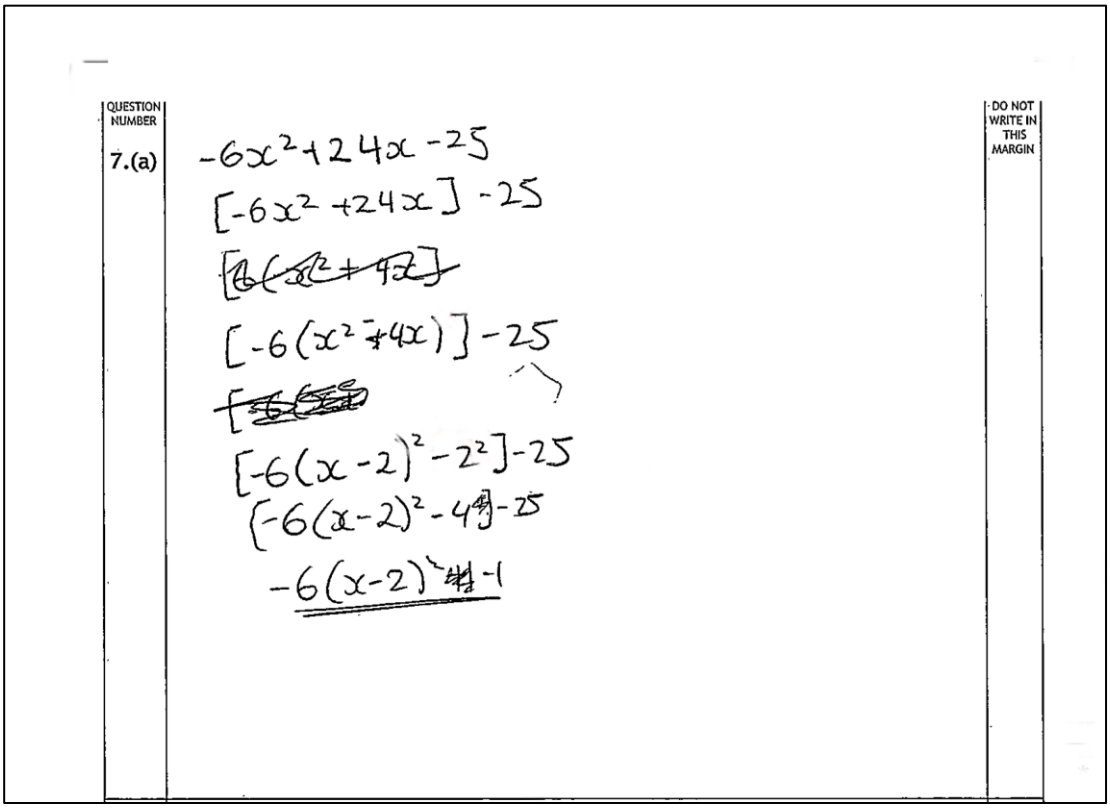
$= \sqrt{13}$

$\Rightarrow 2\cos x - 3\sin x = \sqrt{13}\cos(x + 56.3)$

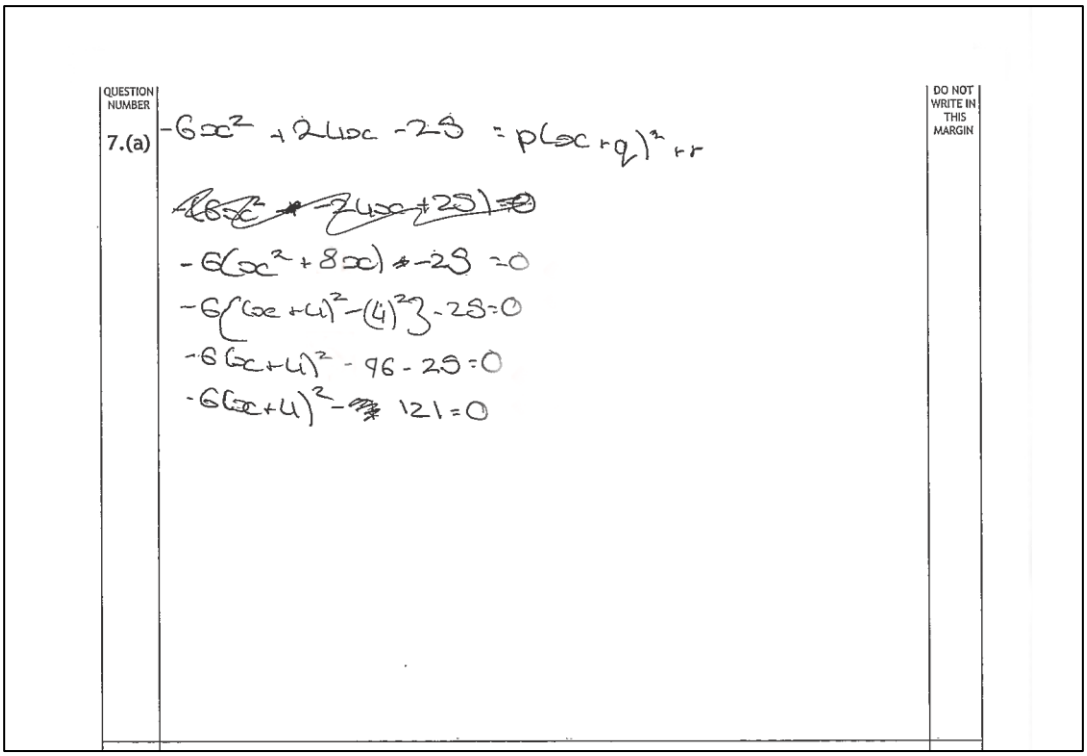
Candidate 12



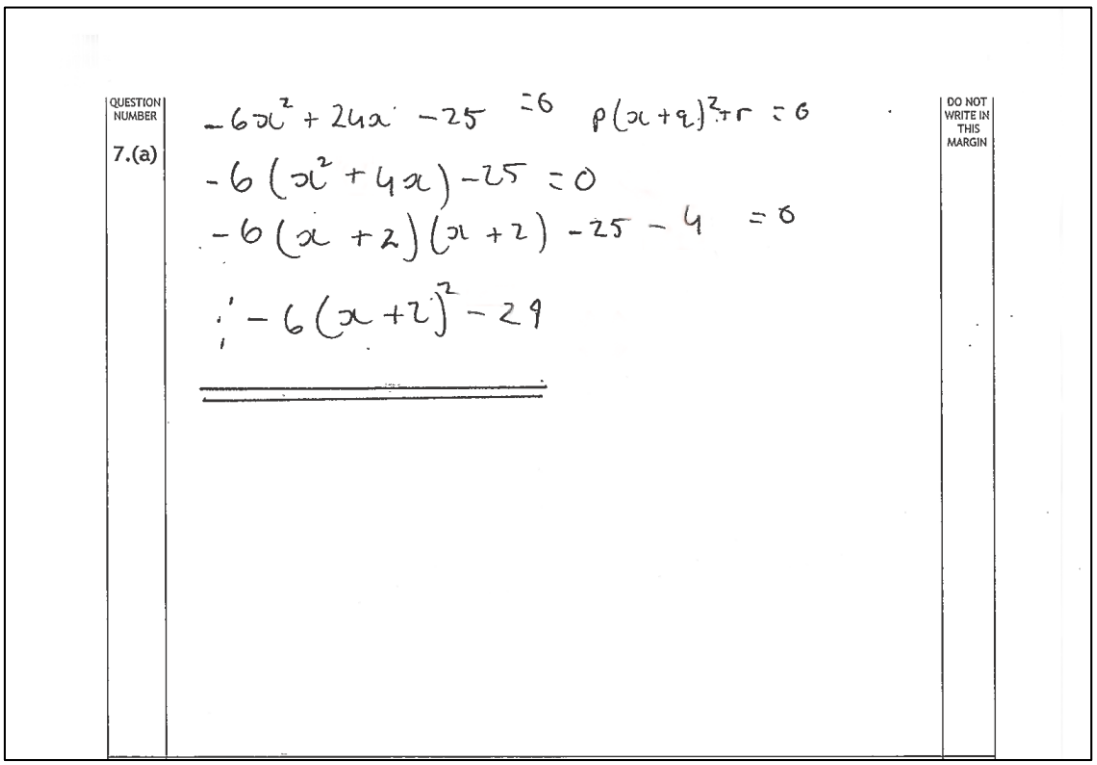
Candidate 13



Candidate 14



Candidate 15



QUESTION NUMBER

7.(a)

$-6x^2 + 24x - 25 = 0 \quad p(x+q)^2 + r = 0$

$-6(x^2 + 4x) - 25 = 0$

$-6(x+2)(x+2) - 25 - 4 = 0$

$\therefore -6(x+2)^2 - 29$

DO NOT WRITE IN THIS MARGIN

Candidate 16

7.(b)	$f(x) = -2x^3 + 12x^2 - 25x + 9$ $f'(x) = -6x^2 + 24x - 25$ $= -6(x-2)^2 - 1$ $\Rightarrow$ maximum value of $f'(x) = -1$ $\therefore f'(x) < 0$ and therefore is strictly decreasing for all values of x

Candidate 17

$y = \sqrt[3]{x} + 8$

$y^3 = x + 8^3$

$y^3 - 512 = x$

$f^{-1}(x) = x^3 - 512$

Candidate 18

QUESTION NUMBER

8.(a)

$f(x) = \sqrt[3]{x} + 8$

$y = \sqrt[3]{x} + 8$

$x = (y-8)^3$

$y = (x-8)^3$

$f^{-1}(x) = (x-8)^3$

DO NOT WRITE IN THIS MARGIN

Candidate 19

QUESTION NUMBER

8.(a) $f(x) = \sqrt[3]{x} + 8$

$y = \sqrt[3]{x} + 8$

$y - 8 = \sqrt[3]{x}$

~~$y - 8 = x^{1/3}$~~

$(y-8)^{1/3} = x$

$y = (x-8)^{1/3}$

$f^{-1}(x) = (x-8)^{1/3}$

DO NOT WRITE IN THIS MARGIN

Candidate 20

QUESTION NUMBER	
9.(a)	$P_t = 120\,e^{-0.0079t}$ $= 120e^{-0.0079(0)}$ $P_t = 119.1$

Candidate 21

9.(b)

$15 = 100e^{-0.0079 \times t}$

$0.15 = e^{-0.0079 \times t}$

$\ln 0.15 = -0.0079 \times t$

$\frac{-1.897}{-0.0079} = t$

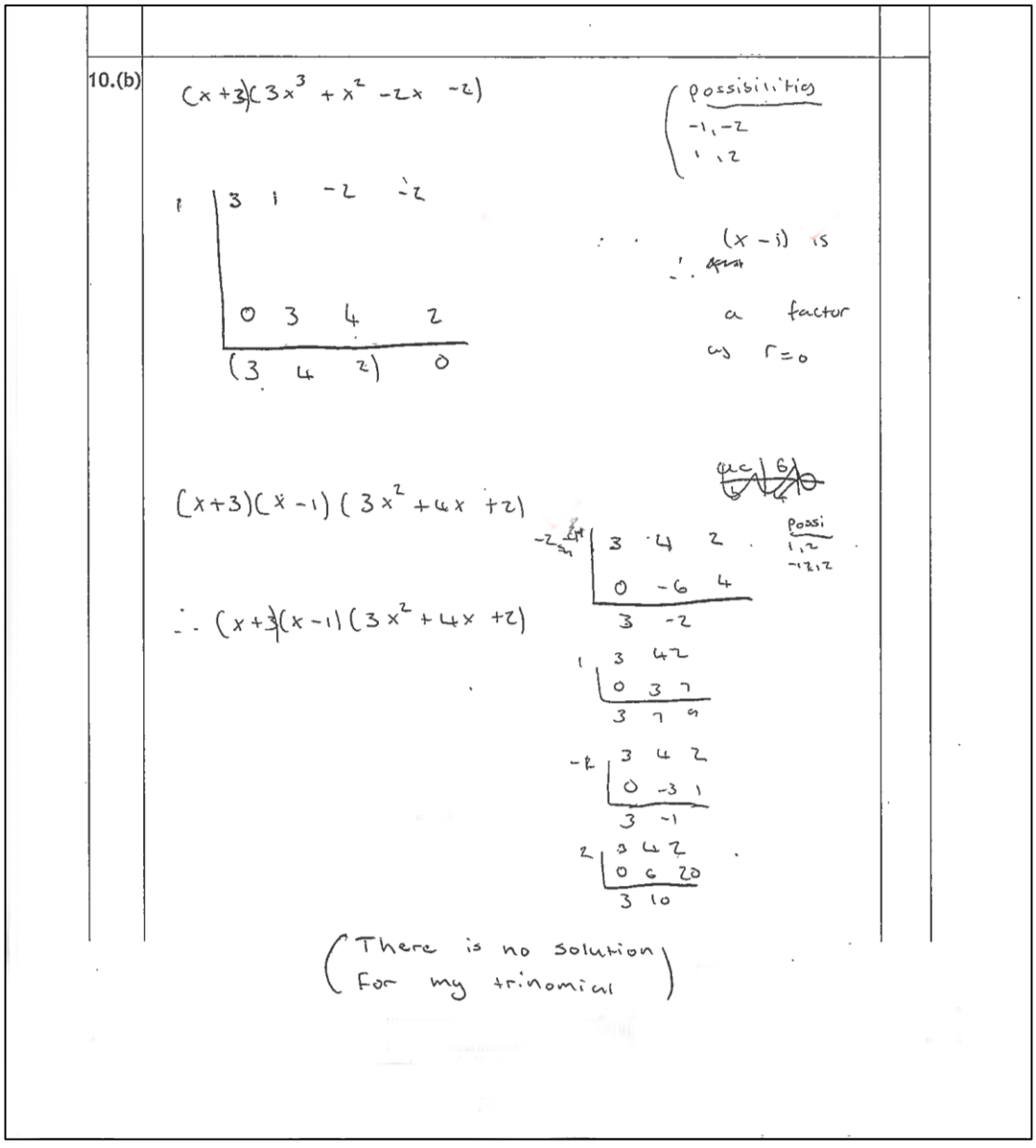
$t = 240.14$ years to reduce to 15%

$P_t = 15\%$

$P_0 = 100\%$

$t = ?$

Candidate 22



Candidate 23

QUESTION NUMBER

11.(b)

DO NOT WRITE IN THIS MARGIN

$A = 16x^2 + \frac{4000}{x} = 16x^2 + 4000x^{-1}$

$A'(x) = 32x + 4000x^{-2}$

$= 32x - 4000x^{-2}$

$32x(1 - 125x^{-3}) = 0$

$32x = 0$

$x = 0$

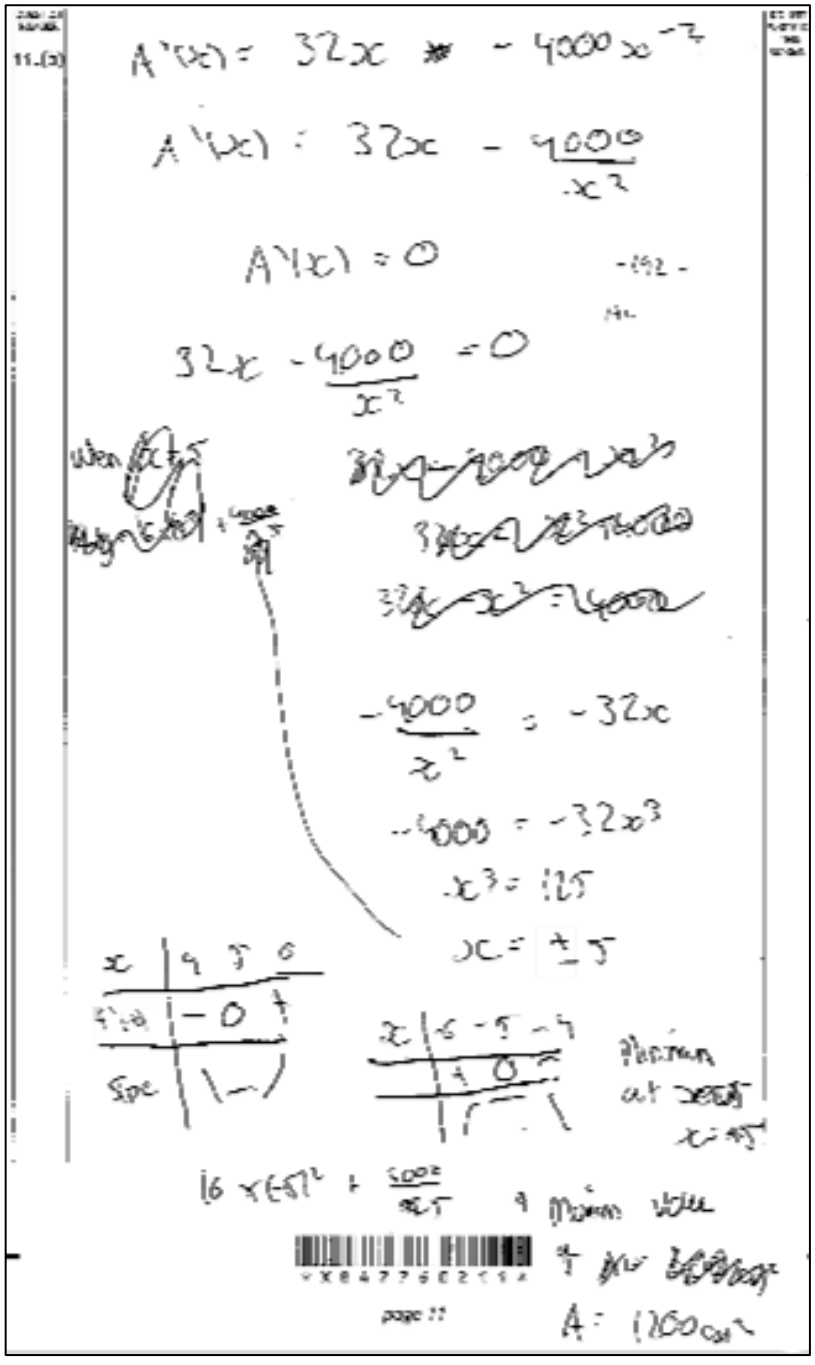
$1 - 125x^{-3} = 0$

$125x^{-3} = 1$

$x^{-3} = \frac{1}{125}$ $x = \sqrt[-3]{\frac{1}{125}}$

$x = 5$

Candidate 24



Candidate 25

QUESTION NUMBER

11.(b)

$A = 16x^2 + \frac{4000}{x}$

$= 16x^2 + 4000x^{-1}$

$A' = 32x^3 - 4000x^0$

$= 32x^3 - 4000$

Stationary points $\Rightarrow A' = 0$

$32x^3 - 4000 = 0$

$32x^3 = 4000$

$x^3 = 125$

$x = 5$

min value? → nature table

x	4 →	5	→ C
$A'(x)$	−	0	+
slope	\	−	/

$A'(4) = 32(4)^3 - 4000$

$= -1952$

$A'(6) = 32(6)^3 - 4000$

$= 2912$

5 is the minimum value of x

Candidate 26

QUESTION NUMBER 12.

$y = ab^x \quad \log_4 y$

$\log_4 y = ab^x$

$\log_4 8 = ab^3$

$\log_4 2^3$

$3\log_4 2 = ab^3$

$a = 3$

$b = 2$

DO NOT WRITE IN THIS MARGIN

Candidate 27

QUESTION NUMBER

12.

DO NOT WRITE IN THIS MARGIN

$y = ab^x$

$\log_4 y$

$\log_4 y = \log_4 ab^x$

$\log_4 y = x \log_4 ab$

$\log_4 y =$

Candidate 28

QUESTION NUMBER

12.

$y = mx + c$

$y = 3x - 1$

$\log_4 y = 3x - 1$

$\log_4 y = 3\log_4 x - 1\log_4 4$

$\log_4 y = \log_4 x^3 - \log_4 4$

~~$\log_4 y = \log_4 x^3$~~

$\log_4 y = \log_4 \left(\frac{x^3}{4}\right)$

$y = \frac{x^3}{4}$

$a = 3 \quad b = 4$

$\frac{y_2 - y_1}{x_2 - x_1} = \frac{8 - (-1)}{3 - 0}$

$= \frac{9}{3} = 3$

DO NOT WRITE IN THIS MARGIN

Candidate 29

QUESTION NUMBER

12.

$y = kx^n$

$\log_4 y = n\log_4 x + \log_4 k$

$y = mx + c$

$3\log_4 x = 0$

$\log_4 x^3 = 0$

$x^3 = 4^0$

$x^3 = 1$

$x = \sqrt[3]{1}$

$x = 1$

$m = \frac{8+1}{3-0}$

$= \frac{9}{3} = 3$

$\log_4 k = -1$

$k = 4^{-1}$

$k = \frac{1}{4}$

$a = \frac{1}{4}$ $b = 1$

DO NOT WRITE IN THIS MARGIN

Candidate 30

$$\int_0^7 3x^2 - 16x + 11 \, dx$$

$$= \left[\frac{3x^3}{3} - \frac{16x^2}{2} + 11x\right]_0^7$$

$$= \left[x^3 - 8x^2 + 11x\right]_0^7$$

$$= 7^3 - 8(7)^2 + 11(7) - 0$$

$$= 343 - 392 + 77$$

$$= 28$$

$f(x) = x^3 - 8x^2 + 11x$

$x = y^3 - 8y^2 + 11y$

Candidate 31

$f(x) = 3x^2 - 16x + 11$ $(7, 0)$

$f'(x) = 6x - 16$ $x = 7$

$x = 7 \quad = 6(7) - 16$

$= 42 - 16$

$= 26$

Candidate 32

$f'(x) = 3x^2 - 16x + 11$

$\int 3x^2 - 16x + 11 \, dx$

$= x^3 - 8x^2 + 11x + C$

$= (7)^3 - 8(7)^2 + 11(7) + C$

$-C = 343 - 392 + 77$

$+C = -658$

$C = 658$

$-C = 28$

$C = -28$

$= x^3 - 8x^2 + 11x - 28$

Candidate 33

$|u| = 4$

$|v| = 5$

$u \cdot (u + v) = 21$

$= u \cdot u + u \cdot v$

$\cos\theta = \dfrac{u \cdot v}{|u||v|}$

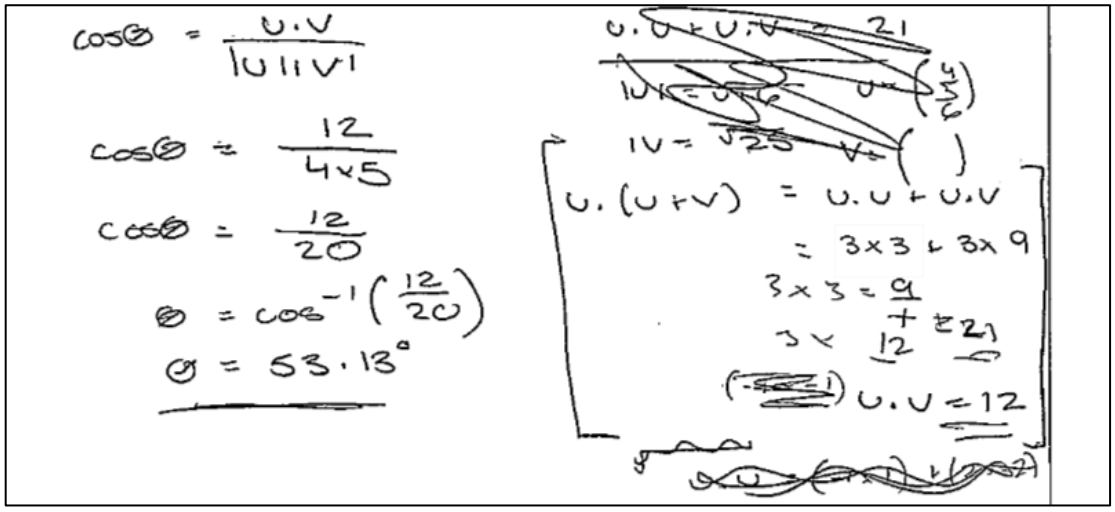
$= \dfrac{17}{20}$

$\theta = \cos^{-1}\left(\dfrac{17}{20}\right)$

$\approx 31.78833062^{\circ}$

$\theta = 31.8^{\circ}$

Candidate 34



Candidate 35

QUESTION NUMBER

15.(a)

Tangent at P

$y - 6 = m(x - a)$ pt $(5, 13)$

$y - 13 = 3(x - 5)$ $m = 3$

$y - 13 = 3x - 15$

$y = 3x - 2$

For m

$m_{PC} = \frac{y_2 - y_1}{x_2 - x_1}$

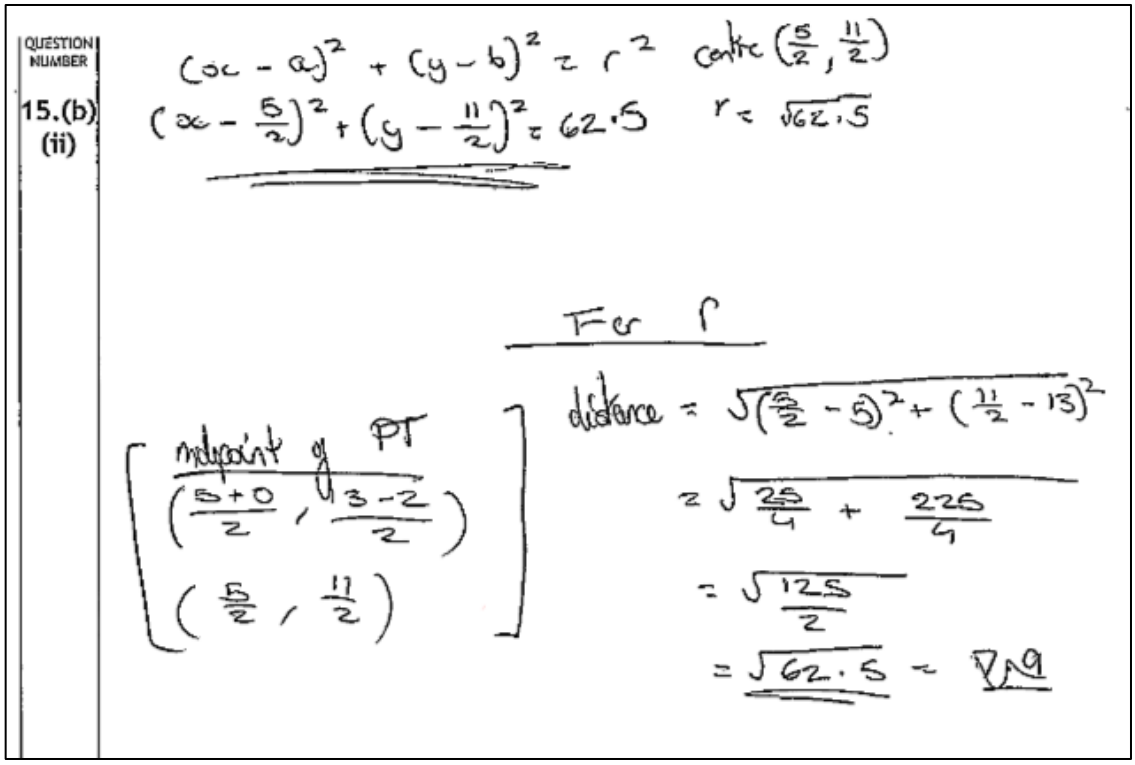
$= \frac{13 - 12}{5 - 8}$

$= \frac{1}{-3}$ $\therefore m$

$= 3$ as $-\frac{1}{3} \times 3 = -1$

DO NOT WRITE IN THIS MARGIN

15.(b) (i) ~~$x = -2, 0$~~ $T = (0, -2)$


QUESTION NUMBER
15.(b)
(ii)
$(x-a)^2+(y-b)^2=r^2$ centre $(\frac{5}{2},\frac{11}{2})$
$(x-\frac{5}{2})^2+(y-\frac{11}{2})^2=62.5$ $r=\sqrt{62.5}$
For r
midpoint of PT
$(\frac{5+0}{2},\frac{3-2}{2})$
$(\frac{5}{2},\frac{11}{2})$
distance $=\sqrt{(\frac{5}{2}-5)^2+(\frac{11}{2}-13)^2}$
$=\sqrt{\frac{25}{4}+\frac{225}{4}}$
$=\sqrt{\frac{125}{2}}$
$=\sqrt{62.5}=r$