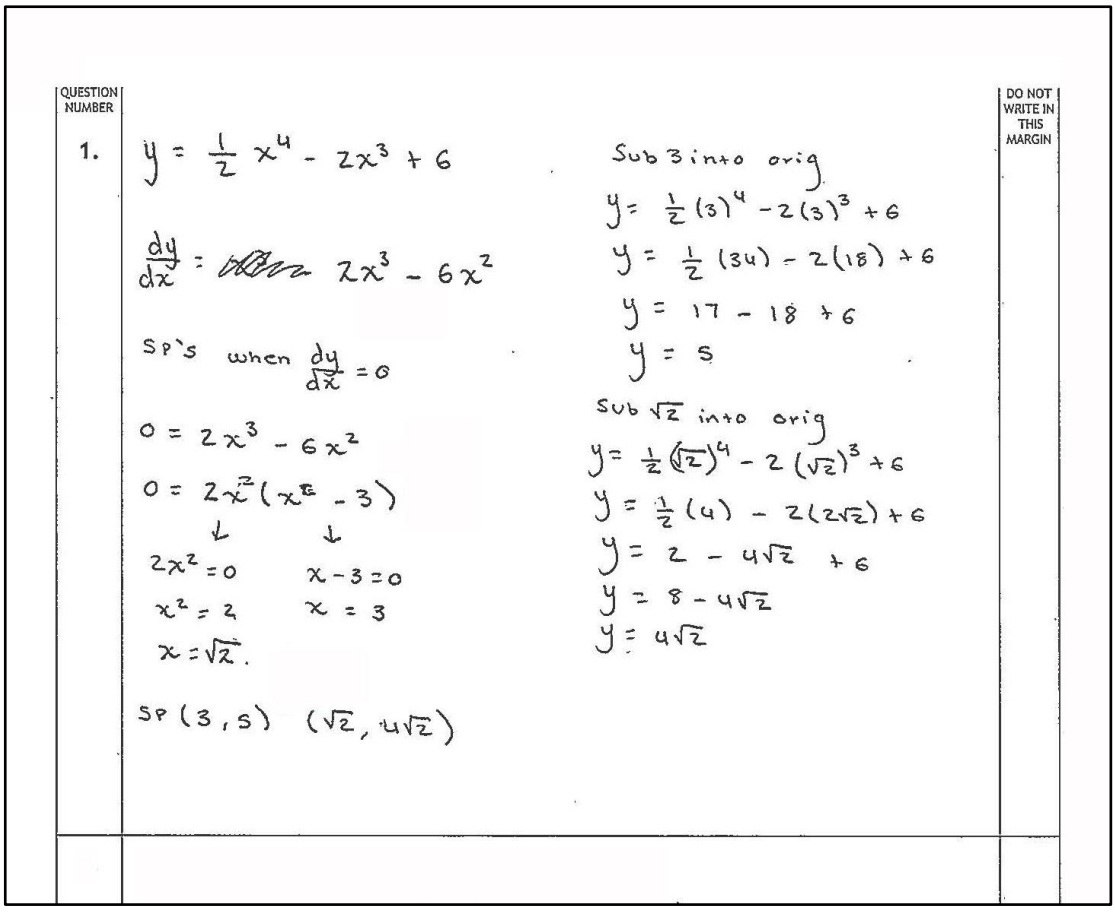
Candidate 1



QUESTION NUMBER

1.

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

$\frac{dy}{dx} = 2x^3 - 6x^2$

SP's when $\frac{dy}{dx} = 0$

$0 = 2x^3 - 6x^2$

$0 = 2x^2(x^2 - 3)$

$2x^2 = 0$ $\quad x - 3 = 0$

$x^2 = 2$ $\quad x = 3$

$x = \sqrt{2}$.

SP $(3, 5)$ $(\sqrt{2}, 4\sqrt{2})$

Sub 3 into orig

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

$y = \frac{1}{2}(34) - 2(18) + 6$

$y = 17 - 18 + 6$

$y = 5$

Sub $\sqrt{2}$ into orig

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

$y = \frac{1}{2}(4) - 2(2\sqrt{2}) + 6$

$y = 2 - 4\sqrt{2} + 6$

$y = 8 - 4\sqrt{2}$

$y = 4\sqrt{2}$

DO NOT WRITE IN THIS MARGIN

1

Candidate 2

QUESTION NUMBER 1.

DO NOT WRITE IN THIS MARGIN

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

$\frac{dy}{dx} = 4 \times \frac{1}{2}x^3 - 2x^2 \times 3$

$\therefore \frac{dy}{dx} = 2x^3 - 6x^2$

For stationary points $\frac{dy}{dx} = 0$

$2x^3 - 6x^2 = 0$

$2x^2(x-6) = 0$

$2x^2 = 0 \quad ; \quad x - 6 = 0$

$x = 0 \text{ or } x = 6$

Candidate 3

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

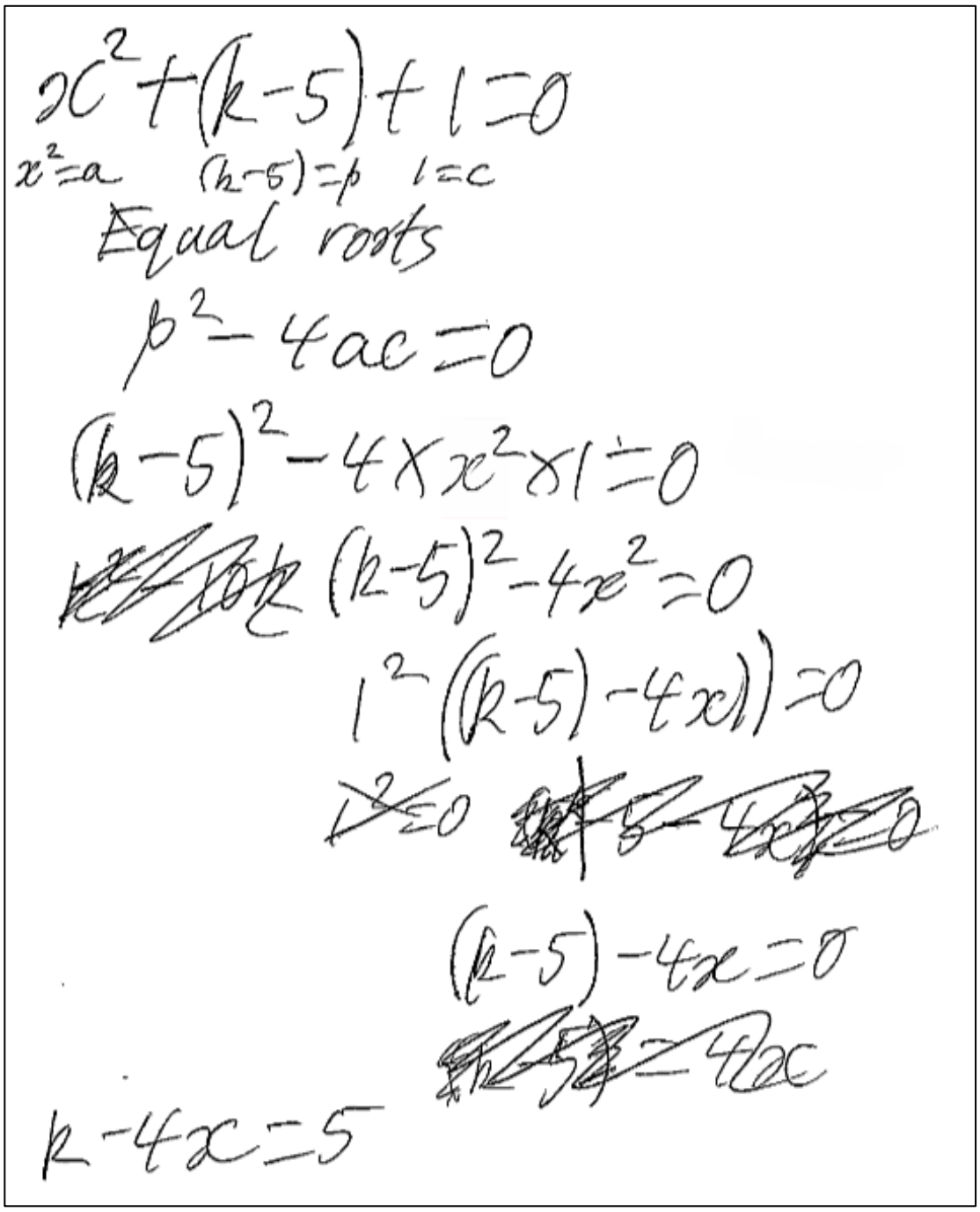
$\frac{dy}{dx} = 2x^3 - 6x^2$

Stationary points occur when $\frac{dy}{dx} = 0$.

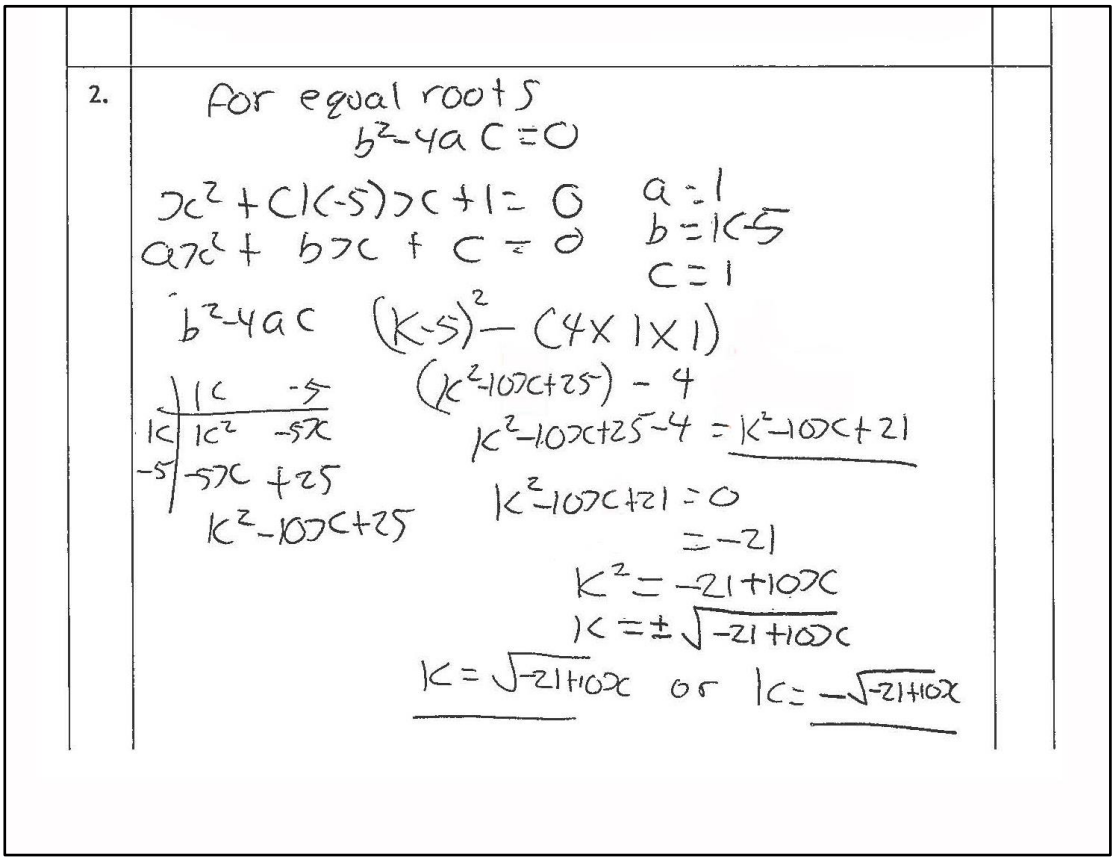
sub $x = 0$ in $\frac{dy}{dx} = 2(0)^3 - 6(0)^2$

$= \underline{0}$ ∴

Candidate 4


$x^2+(k-5)+1=0$
$x^2=a \quad (k-5)=b \quad 1=c$
Equal roots
$b^2-4ac=0$
$(k-5)^2-4\times x^2\times 1=0$
$(k-5)^2-4x^2=0$
$1^2((k-5)-4x1)=0$
$(k-5)-4x=0$
$k-4x=5$

Candidate 5



2. for equal roots
$b^2-4ac=0$

$x^2+(k(-5))x+1=0$ $a=1$
$ax^2+bx+c=0$ $b=k-5$
$c=1$

b^2-4ac $(k-5)^2-(4\times1\times1)$

	k	-5
k	k^2	$-5x$
-5	$-5x$	$+25$

$k^2-10x+25$ $(k^2-10x+25)-4$

$k^2-10x+25-4=k^2-10x+21$

$k^2-10x+21=0$

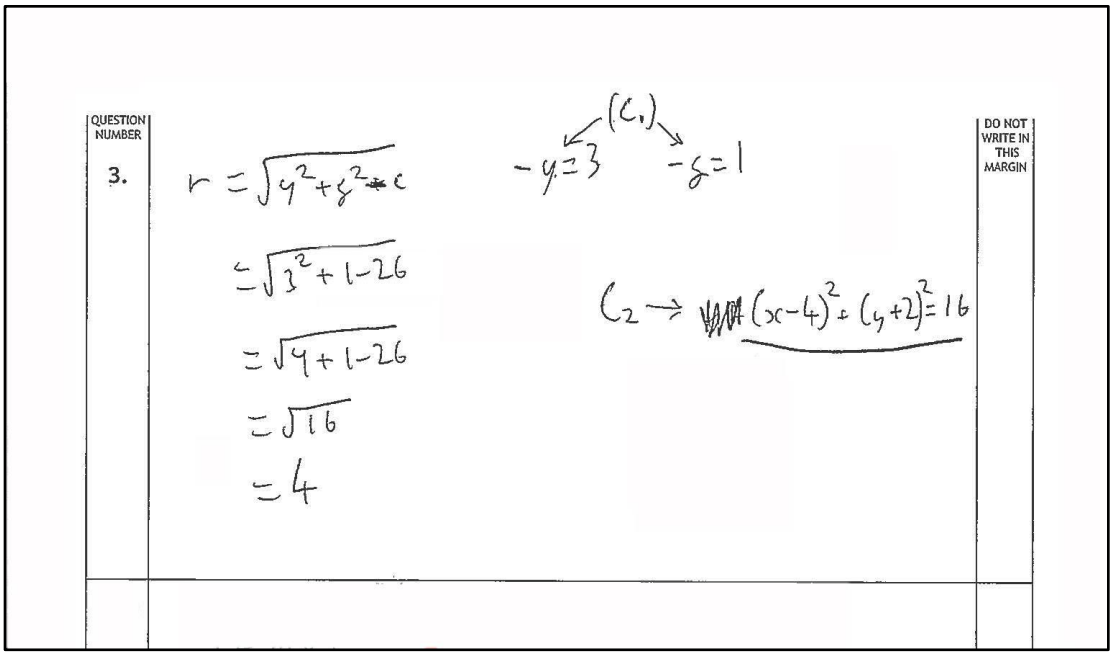
$=-21$

$k^2=-21+10x$

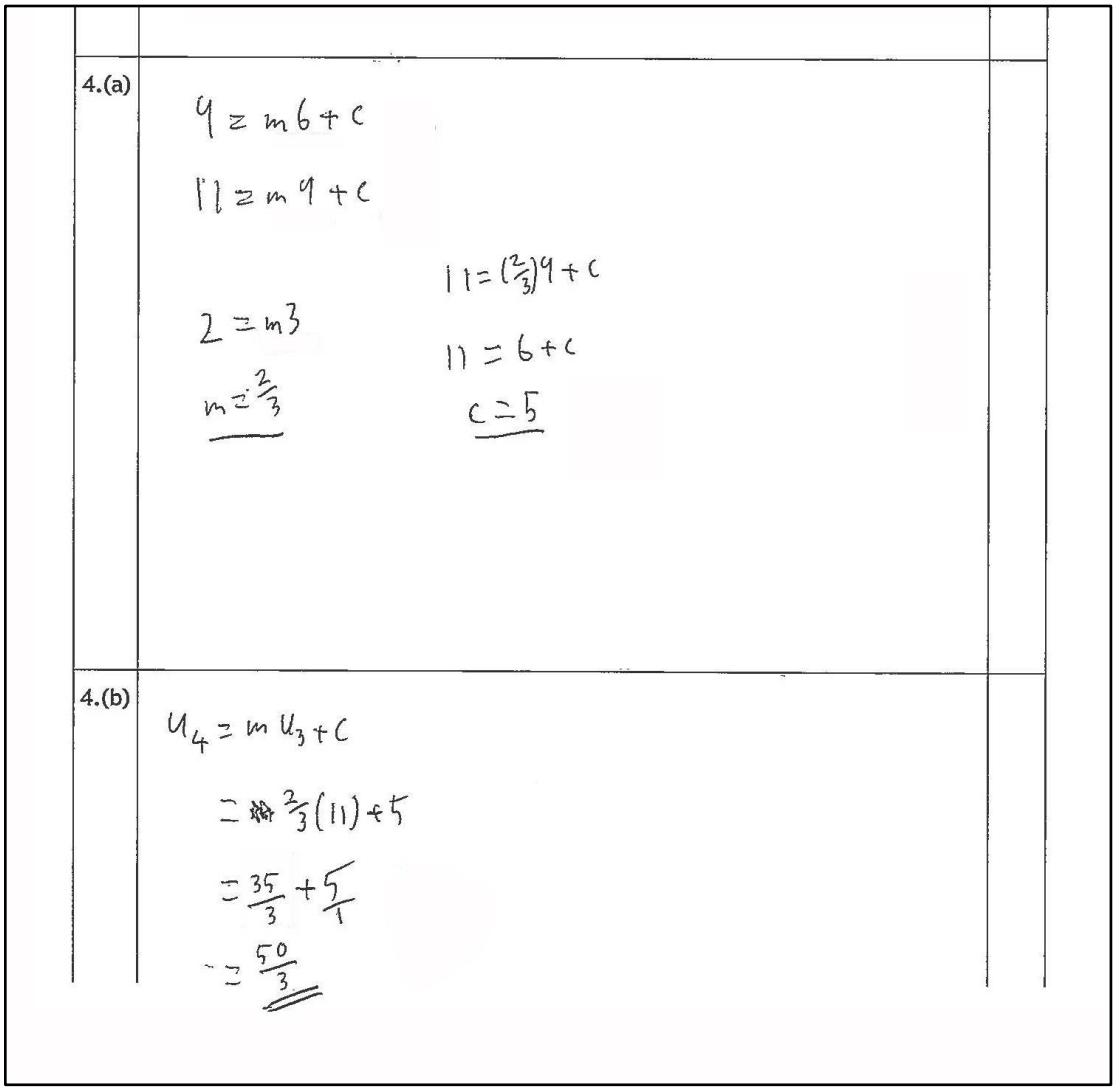
$k=\pm\sqrt{-21+10x}$

$k=\sqrt{-21+10x}$ or $k=-\sqrt{-21+10x}$

Candidate 6


QUESTION NUMBER
3.
DO NOT WRITE IN THIS MARGIN
$r = \sqrt{y^2+g^2-c}$
$= \sqrt{3^2+1-26}$
$= \sqrt{9+1-26}$
$= \sqrt{16}$
$= 4$
(C_1)
$-y=3$
$-g=1$
$C_2 \rightarrow (x-4)^2+(y+2)^2=16$

Candidate 7



4.(a)

$y = mb + c$

$11 = m9 + c$

$2 = m3$

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

$11 = (\frac{2}{3})9 + c$

$11 = 6 + c$

$c = 5$

4.(b)

$u_4 = m u_3 + c$

$= \frac{2}{3}(11) + 5$

$= \frac{35}{3} + \frac{5}{1}$

$= \frac{50}{3}$

Candidate 8

4.(a)

$9 = 6m + c$ $\quad 6m + c = 9$

$11 = 9m + c$ $\quad (-)\ 9m + c = 11$

$-3m = 2$

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

$6\left(-\frac{2}{3}\right) + c = 9$

$-4 + c = 9$

$c = 9 + 4$

$c = 13$

4.(b)

$U_4 = -\frac{2}{3}(11) + 13 = -\frac{22}{3} + 13$

$= -7\frac{1}{3} + 13 = 6\frac{1}{3} = 6{\cdot}33$

$U_4 \# = 6{\cdot}33$

Candidate 9

4.(a)

$u_{n+1} = mu_n + c \qquad u_0 = 6 \quad u_{12} = 9 \quad u_{28} = 11$

$9 = m(6) + c$

$11 = m(9) + c$

$9m + c - 11 = (6m + c - 9)$

$3m = 2$

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

$9 = 6 \times \frac{2}{3} + c$

$9 = 4 + c \qquad c = 5$

4.(b)

$u_3 = 11m + c$

$u_3 = 11 \times \frac{2}{3} + 5$

$u_3 = \frac{22}{3} + 5 = \frac{22}{3} + \frac{15}{3} = \frac{37}{3}$

$u_4 = \frac{37}{3} m + c = \frac{37}{3} \times \frac{2}{3} + 5$

$= \frac{74}{9} + \frac{45}{9} = \frac{119}{9}$

Candidate 10

QUESTION NUMBER

5.(a)

DO NOT WRITE IN THIS MARGIN

$\overrightarrow{AB} = b - a$

$= \begin{pmatrix} 4 \\ -1 \\ 0 \end{pmatrix} - \begin{pmatrix} 1 \\ 5 \\ -3 \end{pmatrix}$

$= \begin{pmatrix} 3 \\ -6 \\ 3 \end{pmatrix}$

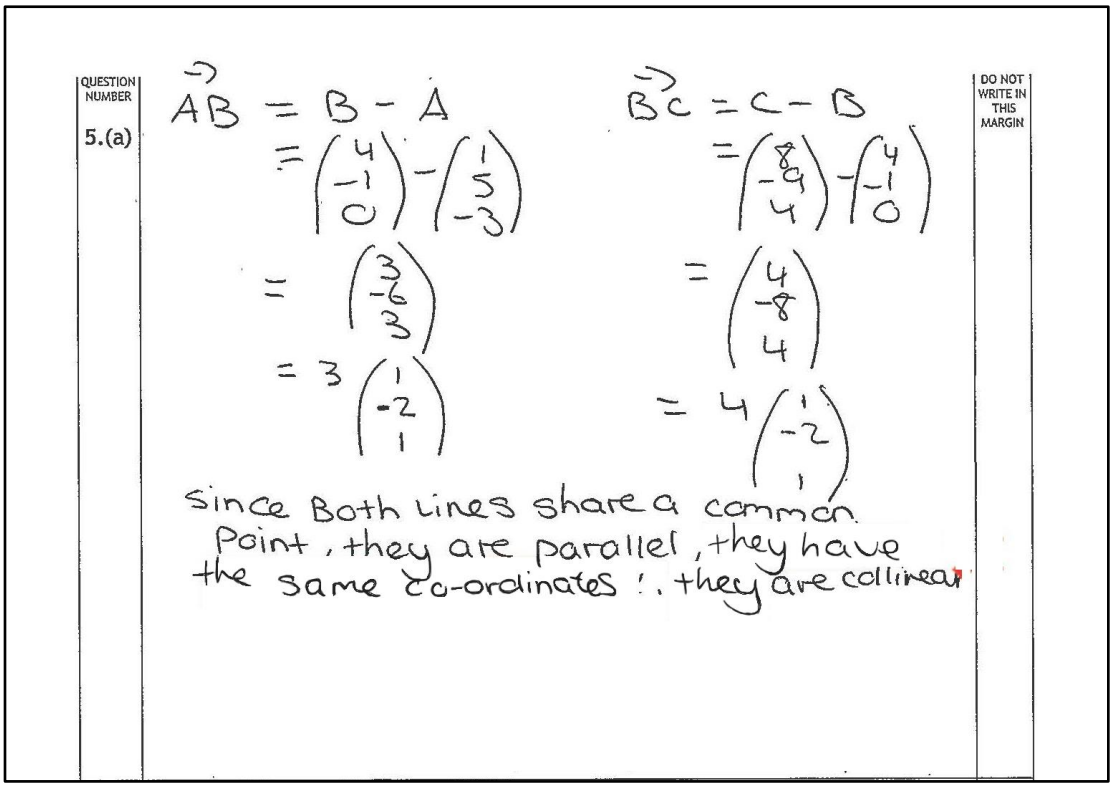
$\overrightarrow{BC} = c - b$

$= \begin{pmatrix} 8 \\ -4 \\ 4 \end{pmatrix} - \begin{pmatrix} 4 \\ -1 \\ 0 \end{pmatrix}$

$= \begin{pmatrix} 4 \\ -8 \\ 4 \end{pmatrix}$

$\overrightarrow{AB} = \frac{3}{4}\overrightarrow{BC}$ so the vectors are parallel, and as B is a common point, the vectors are collinear

Candidate 11

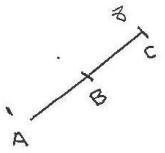


Candidate 12

QUESTION NUMBER

5.(a)

A(1,5,-3) B(4,-1,0) C(8,-9,4)



$\overrightarrow{AB} = \underline{b} - \underline{a}$

$= \begin{pmatrix} 4 \\ -1 \\ 0 \end{pmatrix} - \begin{pmatrix} 1 \\ 5 \\ -3 \end{pmatrix}$

$= \begin{pmatrix} 3 \\ -6 \\ -3 \end{pmatrix}$

$\overrightarrow{BC} = \underline{c} - \underline{b}$

$= \begin{pmatrix} 8 \\ -9 \\ 4 \end{pmatrix} - \begin{pmatrix} 4 \\ -1 \\ 0 \end{pmatrix}$

$= \begin{pmatrix} 4 \\ -8 \\ 4 \end{pmatrix}$

Since $\overrightarrow{AB} = \overrightarrow{BC}$ they are parallel
and since B is a common point A, B, C are collinear

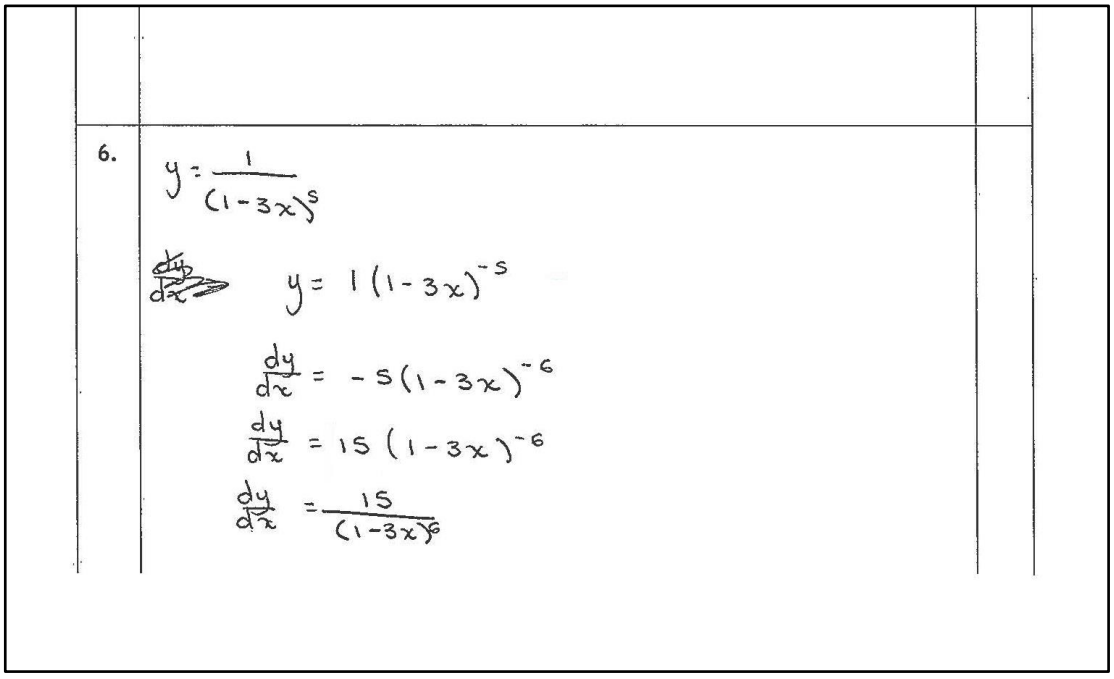
DO NOT WRITE IN THIS MARGIN

5.(b)

1 : 1

~~19~~

Candidate 13



6. $y = \frac{1}{(1-3x)^5}$

$y = 1(1-3x)^{-5}$

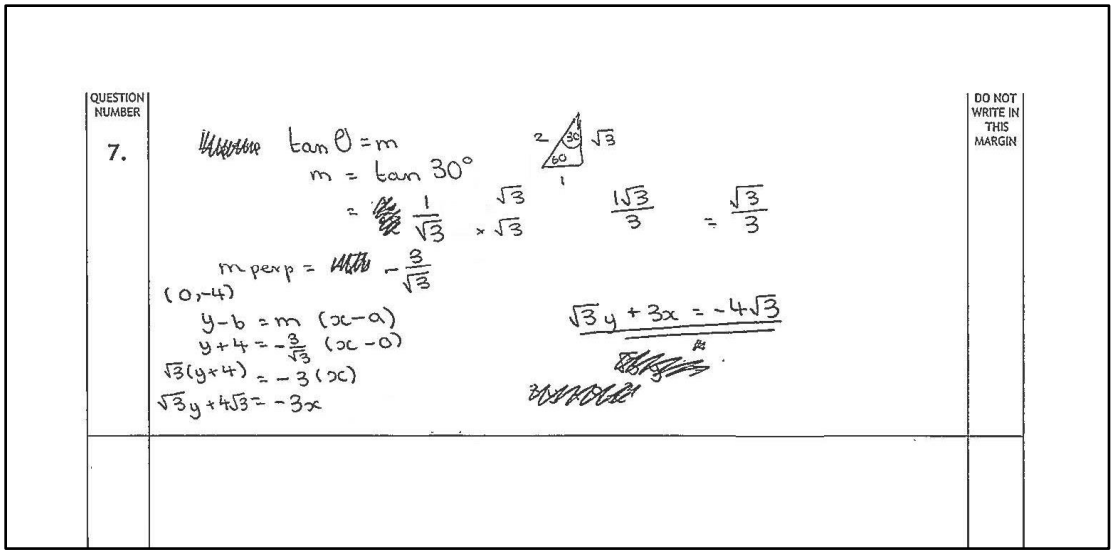
$\frac{dy}{dx} = -5(1-3x)^{-6}$

$\frac{dy}{dx} = 15(1-3x)^{-6}$

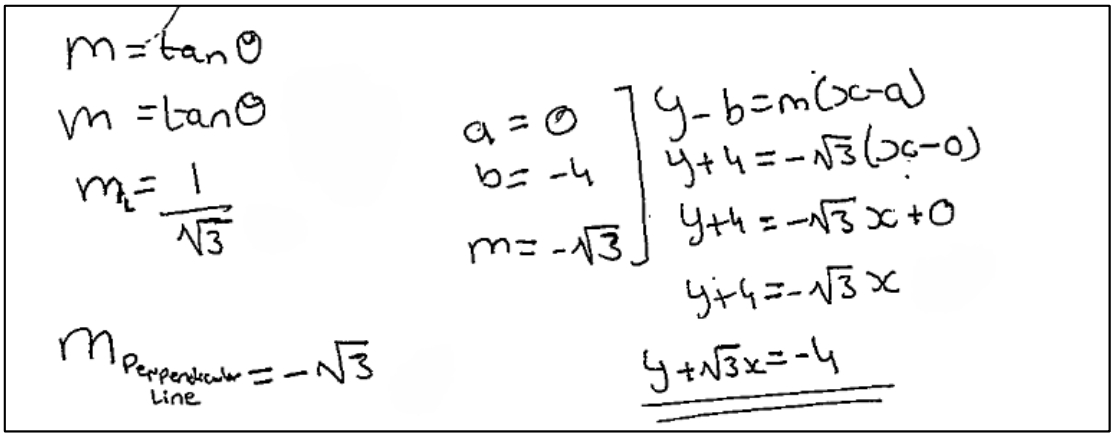
$\frac{dy}{dx} = \frac{15}{(1-3x)^6}$

19

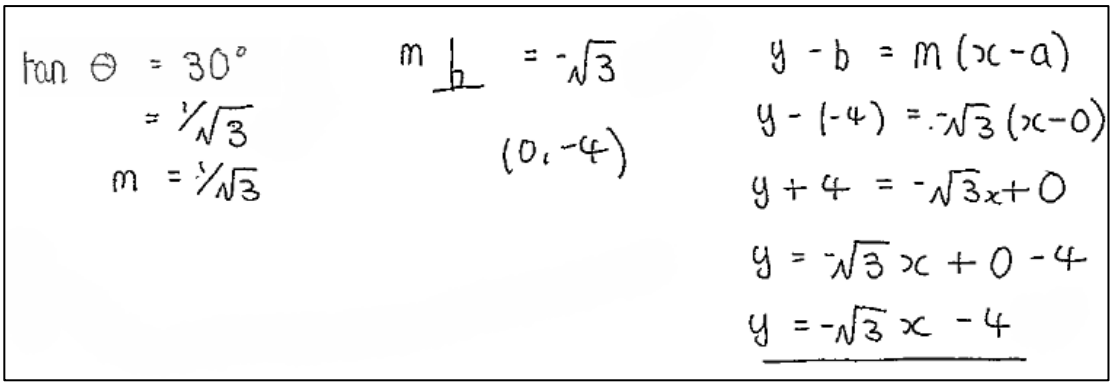
Candidate 14



Candidate 15



Candidate 16



19

Candidate 17

8.(a) $y = y$

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

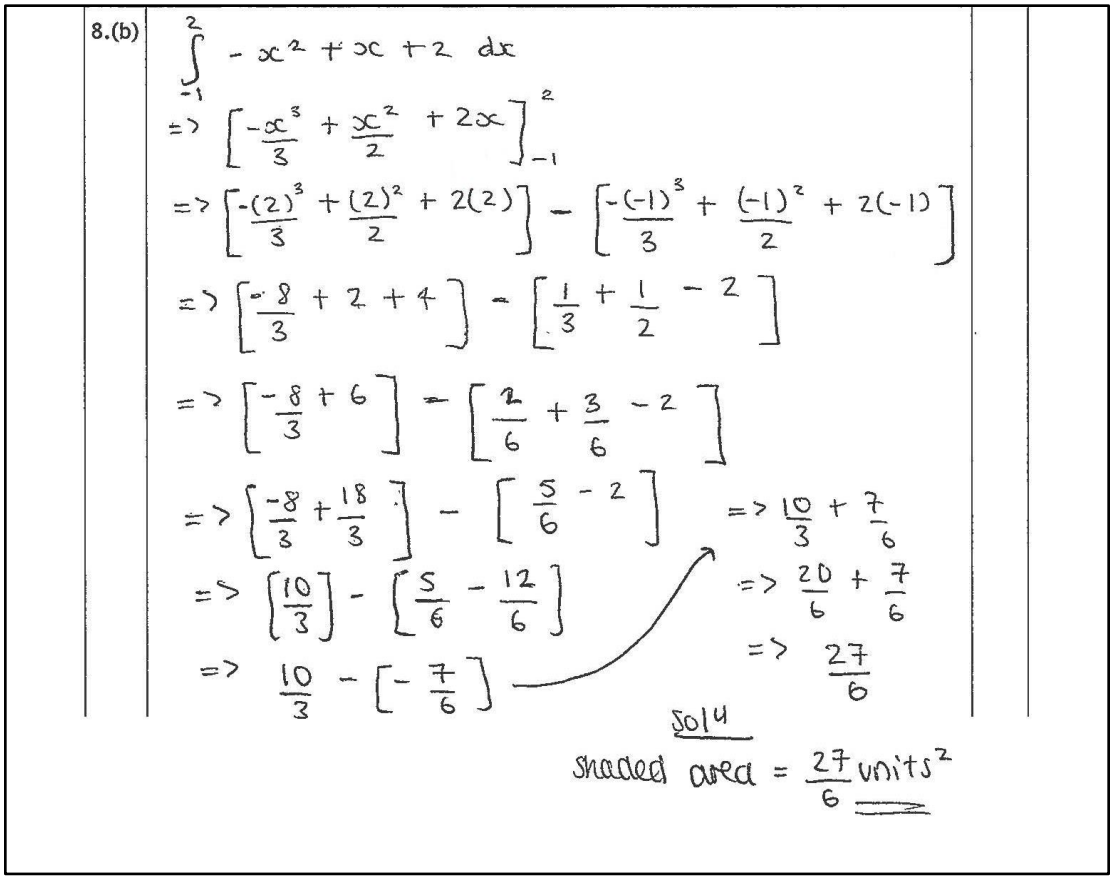
$2x^2 + x + 1 - x^2 - 2x - 3 = 0$

$x^2 - x - 2 = 0$

$\int_{-1}^{2} x^2 - x - 2 \, dx$

19

Candidate 18



Candidate 19

8.(a)

upper − lower

$\int_{-1}^{2} (x^2 + 2x + 3 - (2x^2 + x + 1))\,dx$

$\int_{-1}^{2} (x^2 + 2x + 3 - 2x^2 - x - 1)\,dx$

$\int_{-1}^{2} (-x^2 + x + 2)\,dx$ $\left[-\frac{x^3}{3} + \frac{x^2}{2} + 2x\right]_{-1}^{2}$

8.(b)

upper − lower

$\int_{-1}^{2} ((x^2 + 2x + 3) - (2x^2 + x + 1))\,dx$

$\int_{-1}^{2} (x^2 + 2x + 3 - 2x^2 - x - 1)\,dx$

$\int_{-1}^{2} (-x^2 + x + 2)\,dx$

$\left[-\frac{x^3}{3} + \frac{x^2}{2} + 2x\right]_{-1}^{2}$

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

$= \left(-\frac{8}{3} + 2 + 4\right) - \left(\frac{1}{3} + \frac{1}{2} - 2\right)$

$\left(-\frac{8}{3} + 6\right) - \left(\frac{5}{6} - 2\right)$

$-\frac{10}{3} - \left(-\frac{7}{6}\right) = \frac{27}{6}$ //

19

Candidate 20

9.(a) (i)

$p(2p+16)+6+24$

$p(2p+16)+30$

$2p^2+16p+30$

9.(a) (ii)

$p(2p+16)+30=0$

~~$p(2p+16)=-30$~~

~~$p=-30$~~

$p=-5$

$p=-3$

$2p^2+16p+30$

$p^2+16p+60$

$(p+10)(p+6)$

$(p+\frac{10}{2})(p+\frac{6}{2})$

$(p+5)(p+3)$

$2p+16=30$

$2p=30-16$

$2p=14$

$p=23$

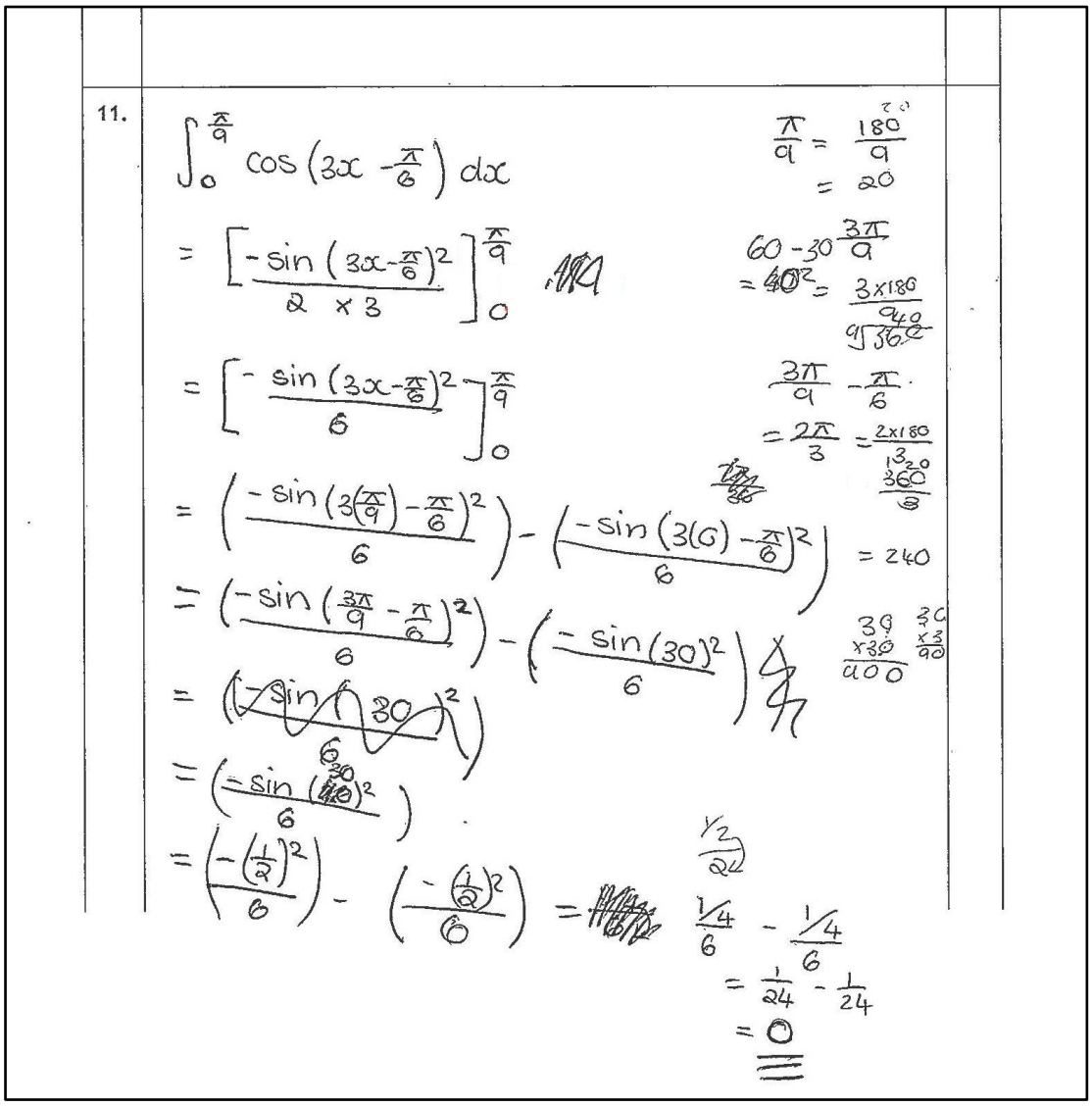
$\sqrt{60}$

$\sqrt{68}$

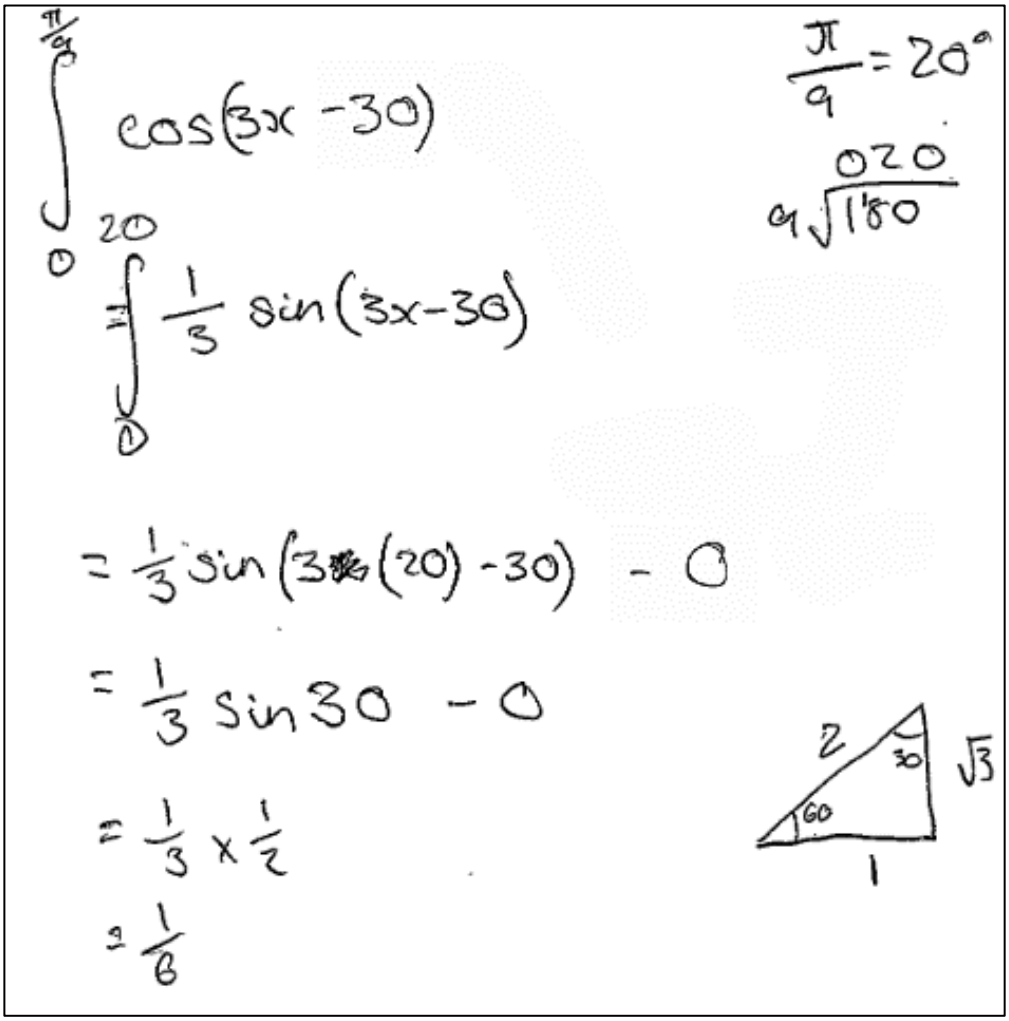
Candidate 21

QUESTION NUMBER	
9.(a) (i)	$u.v = (p \times (2p+16)) + (-7 \times -3) + (4 \times 6)$ $= 2p^2 + 16p + 6 + 24$ $= 2p^2 + 16p + 30$ $= p^2 + 8p + 15$
9.(a) (ii)	$u = \begin{pmatrix} p \\ -2 \\ 4 \end{pmatrix}$ $v = \begin{pmatrix} 2p+16 \\ -3 \\ 6 \end{pmatrix}$ M 1 A 1 $p^2 + 8p + 15$ 3, 5 $(p+3)(p+5)$ $p = -3$ or -5 = perpendicular - Vectors $h = \frac{1}{3}$ or $\frac{1}{5}$

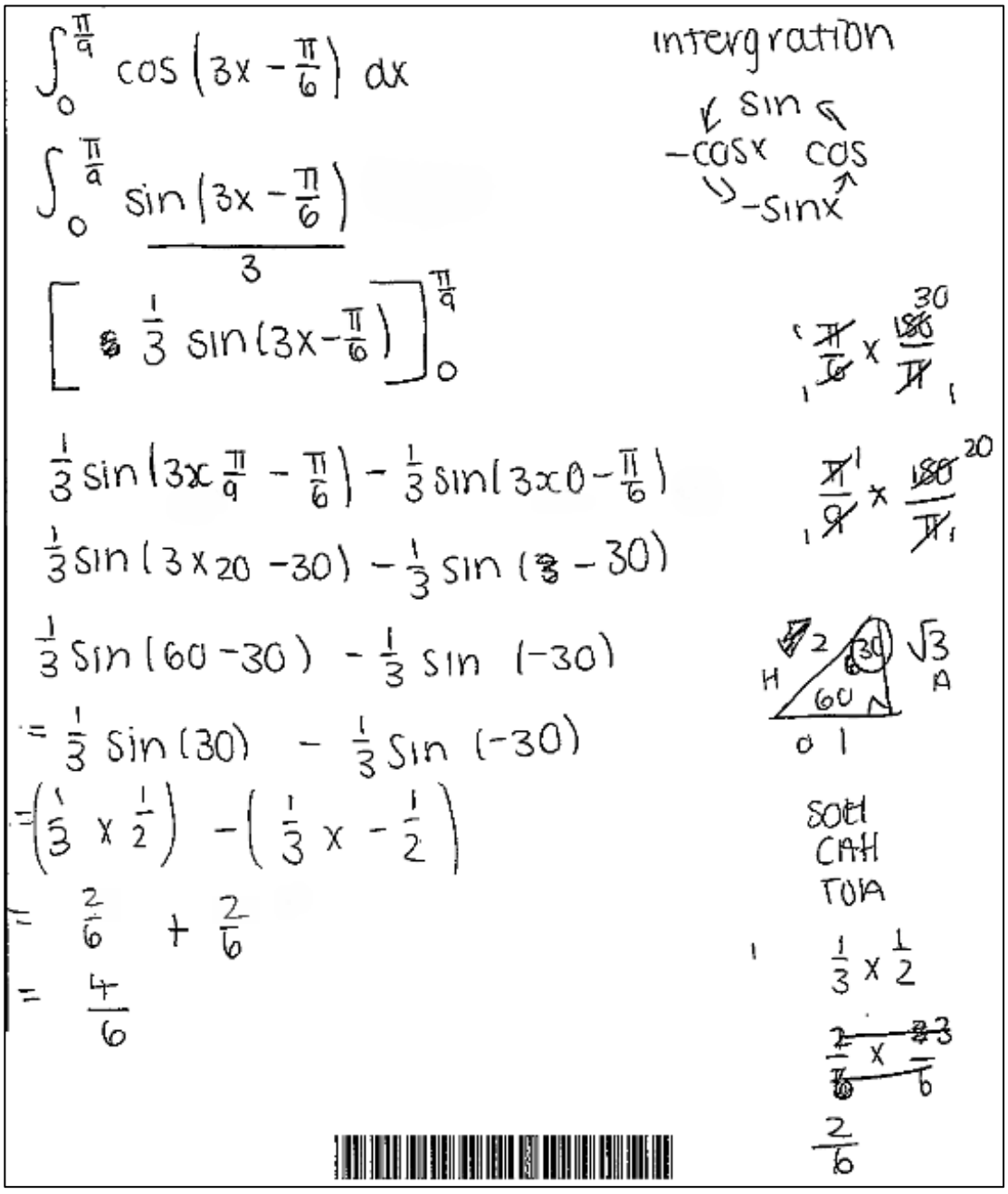
Candidate 22



Candidate 23



Candidate 24



Candidate 25

QUESTION NUMBER

12.(a)

$f(x) = \frac{1}{\sqrt{x}}$ $\quad g(x) = 5 - x$

$f(g(x)) = f(5-x)$

$f(5-x) = \frac{1}{\sqrt{x}}$

$= \frac{1}{\sqrt{(5-x)}}$

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

DO NOT WRITE IN THIS MARGIN

Candidate 26

$\sin(p+q) = \sin p \cos q + \cos p \sin q$ $\quad \sin q = \frac{1}{\sqrt{10}}$

$= \frac{1}{\sqrt{5}} \times \frac{3}{\sqrt{10}} + \frac{3}{\sqrt{5}} \times \frac{1}{\sqrt{10}}$ $\quad \sin p = \frac{1}{\sqrt{5}}$

$= \frac{3}{25\sqrt{2}} + \frac{2}{25\sqrt{2}}$

$= \frac{5}{25\sqrt{2}}$

$= \frac{1}{5\sqrt{2}}$

19

Candidate 27

$\log_{10}4 + 2\log_{10}5$

$\log_{10}4 + \log_{10}5^2$

$\log_{10}4 + \log_{10}25$

$\log_{10}(25 \times 4)$

$\log_{10}100$

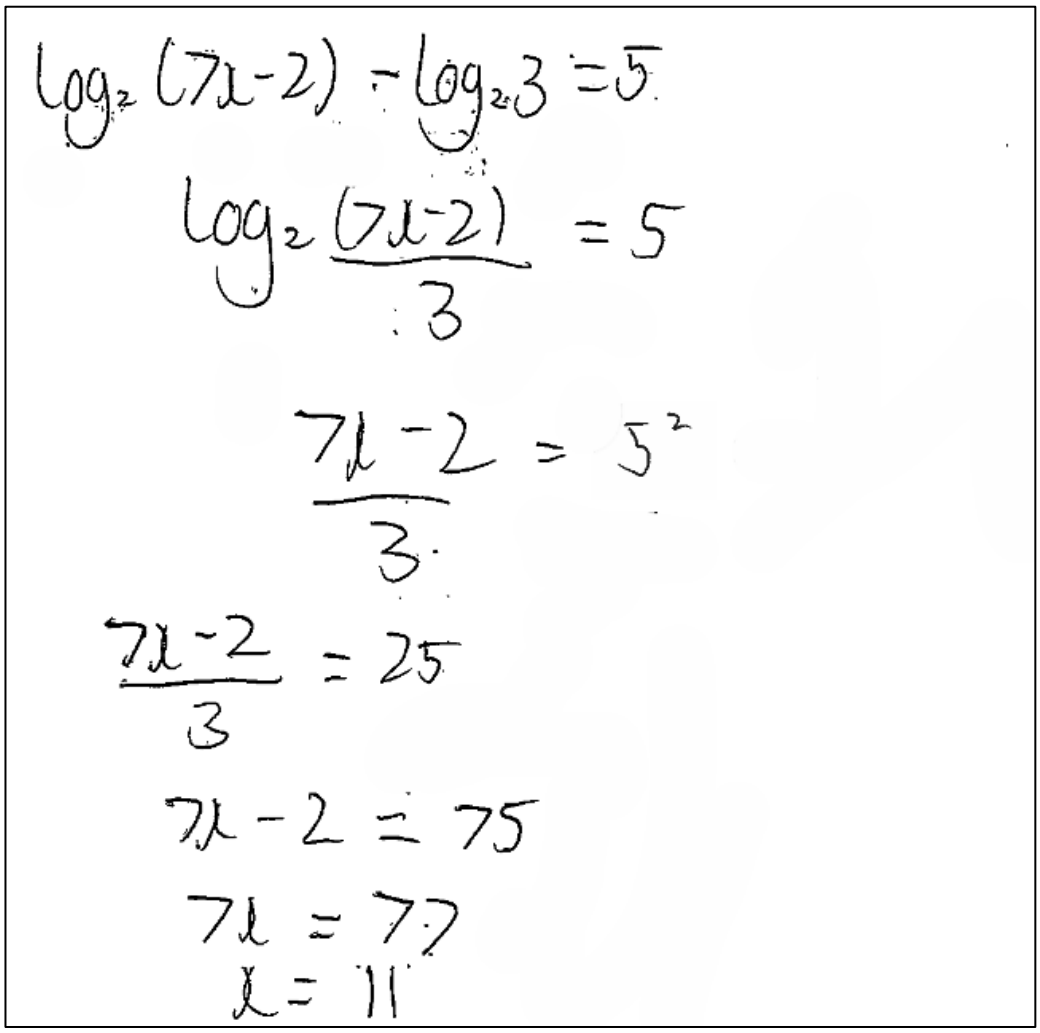
$10^x = 100$

$10^2 = 100$

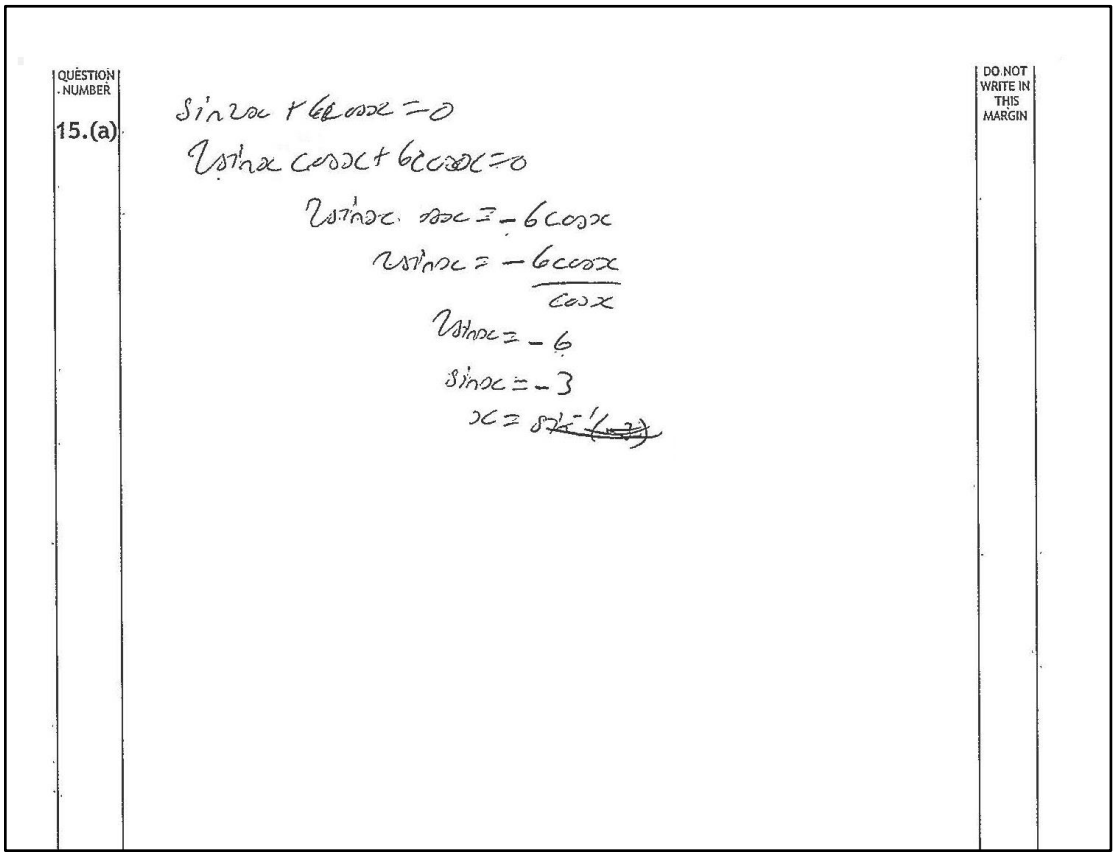
$x = 2$

~~19~~

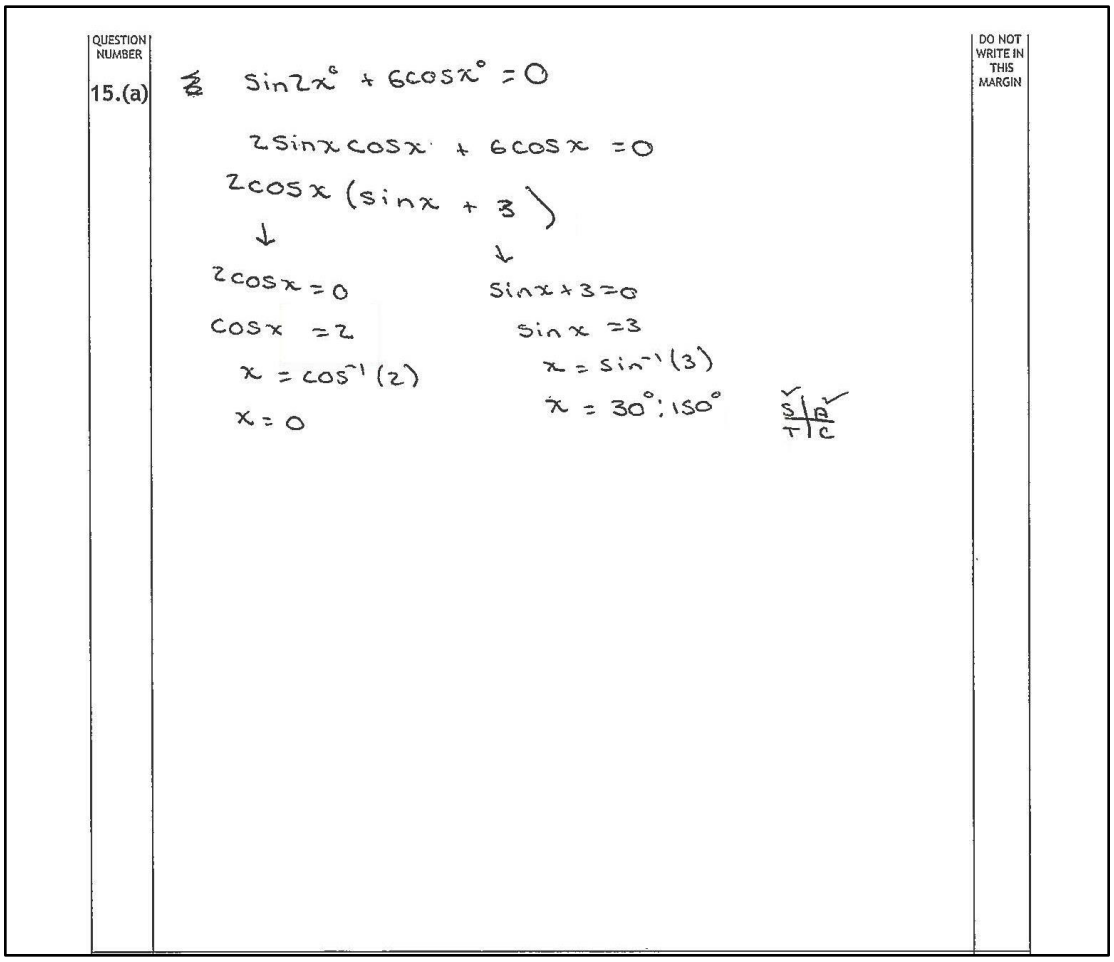
Candidate 28



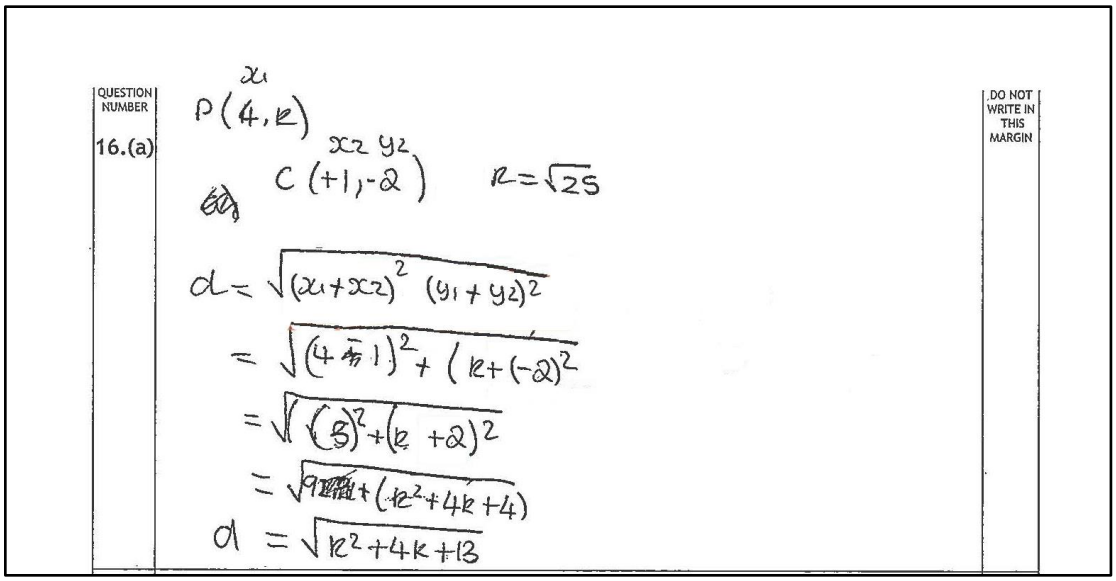
Candidate 29



Candidate 30



Candidate 31



Candidate 32

QUESTION NUMBER

16.(a)

$P(4, k)$

$C(1, -2)$

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

$= \sqrt{9 + k^2 - 4k + 4}$

$= \sqrt{k^2 - 4k + 13}$

DO NOT WRITE IN THIS MARGIN

16.(b)

~~d, r, r~~ $d > r$

$r = r$ of circle $= 5$

~~r_2 = distance between circumference and point P.~~

$\therefore \sqrt{k^2 - 4k + 13} > 5$

$k^2 - 4k + 13 > 25$

$k^2 - 4k - 12 > 0$

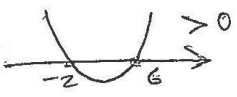
roots

$x^2 - 4x - 12 = 0$

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

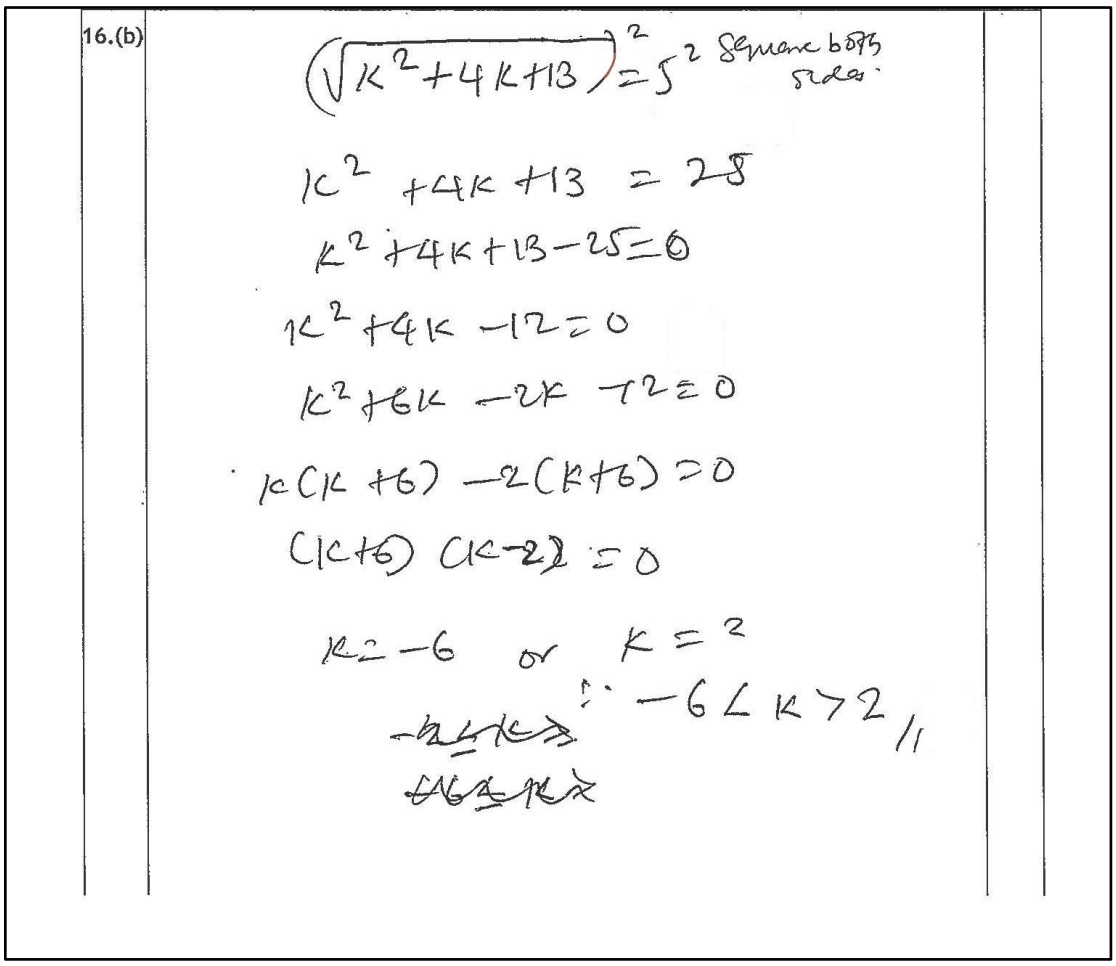
$x = 6, \ x = -2$

sketch

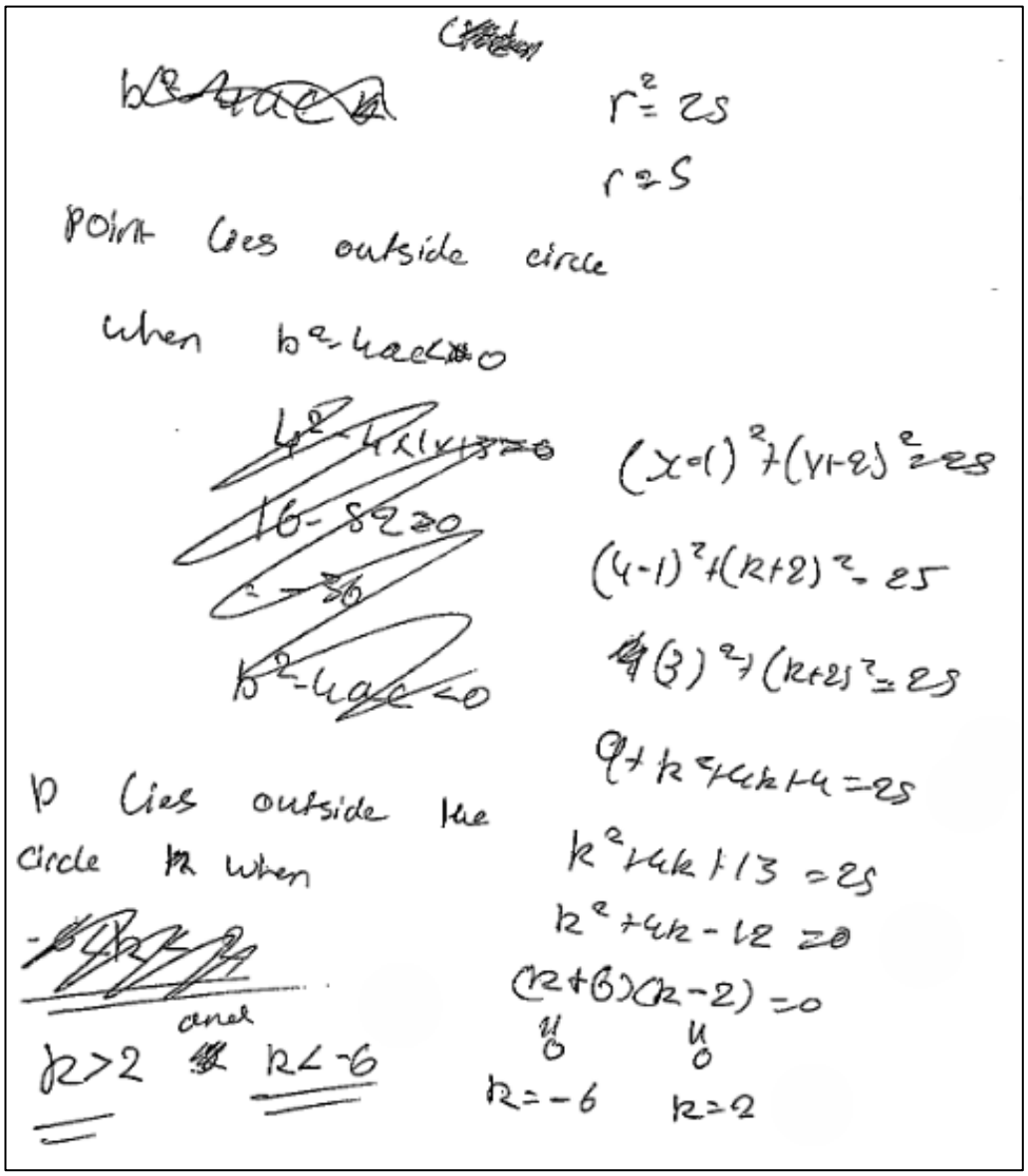


$k < -2, k > 6$

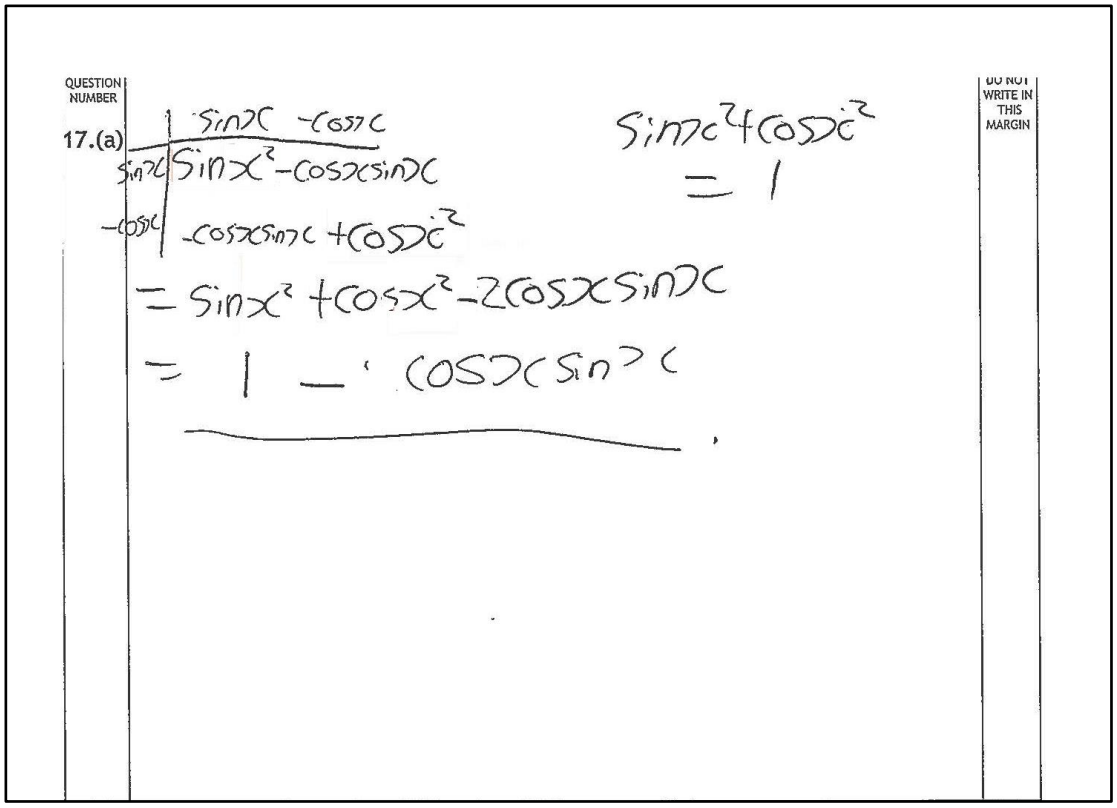
Candidate 33



Candidate 34



Candidate 35



Candidate 36

QUESTION NUMBER

17.(a)

$\sin^2 x - \cos^2 x$

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

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

$\sin^2 x = 1 - \cos^2 x$

$\sin^2 x - \cos^2 x = 1$

$= 1 + 2\sin 2x$

$\sin 2x - \cos 2x$

$= 2\sin x \cos x - 2\cos^2 x - 1$

$= \sin x - \cos x - 1 \equiv 0$

17.(b)

$\int (\sin x - \cos x)^2 \, dx$

$\int 1 + 2(\sin 2x) \, dx$

$= x + 2\left(\frac{1}{2}\right)\cos 2x + c$

$= x - \cos 2x + c$