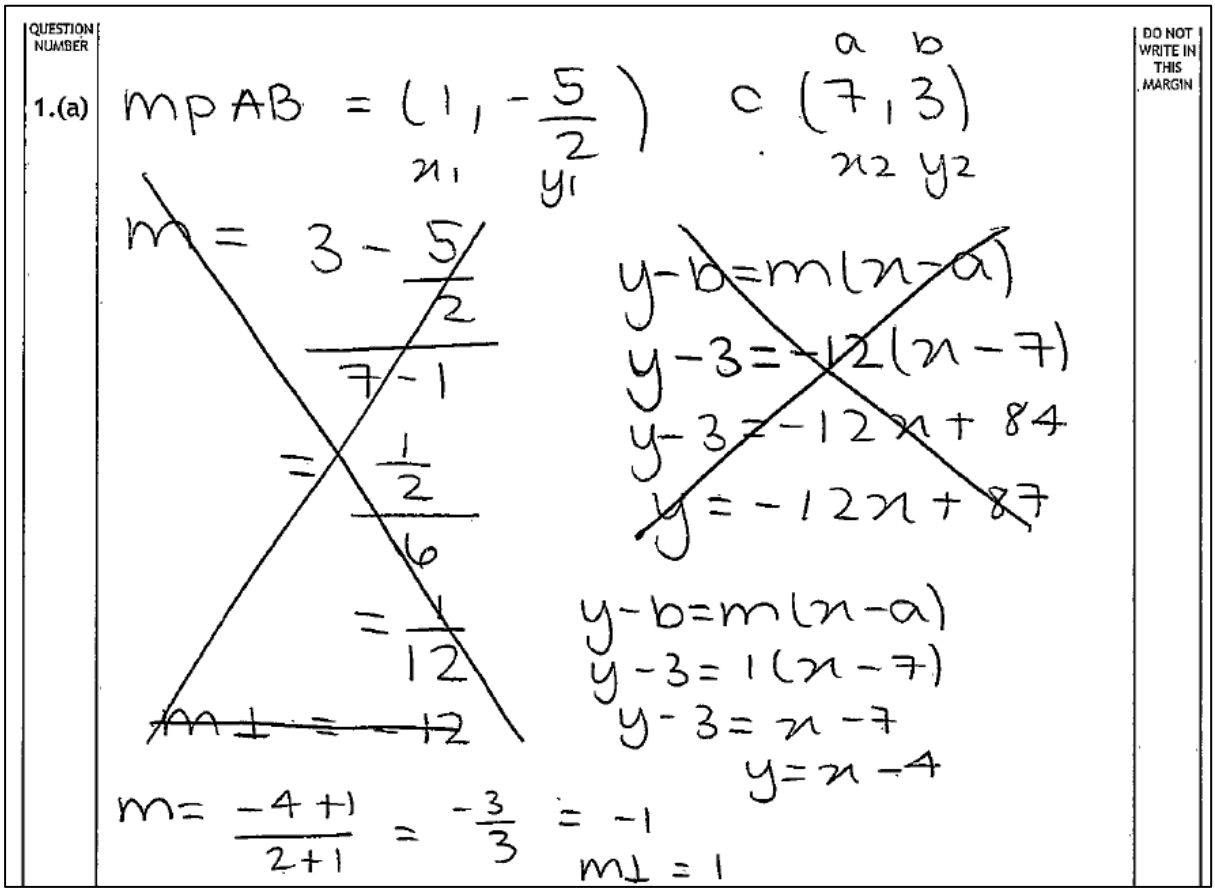
Candidate 1


QUESTION NUMBER
1.(a)
DO NOT WRITE IN THIS MARGIN
mp AB = (1, -5/2)
x1 y1
C (7, 3)
a b
x2 y2
m = 3 - 5/2 / 7 - 1
= 1/2 / 6
= 1/12
m⊥ = -12
y - b = m(x - a)
y - 3 = -12(x - 7)
y - 3 = -12x + 84
y = -12x + 87
y - b = m(x - a)
y - 3 = 1(x - 7)
y - 3 = x - 7
y = x - 4
m = -4 + 1 / 2 + 1 = -3/3 = -1
m⊥ = 1

1.(b)

$A(-1,-1)$ $C(7,3)$ $B(2,-4)$

x_2 y_2

a b

$mp = (3, 1)$

x_1 y_1

$m = \dfrac{-4-1}{2-3}$

$= \dfrac{-5}{-1}$

$= 5$

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

$y + 4 = 5(x - 2)$

$y + 4 = 5x - 10$

$y = 5x - 14$

QUESTION NUMBER

1.(c)

$y = -12x + 87$

$y = 5x - 14$

$5x - 14 = -12x + 87$

$17x - 14 = 87$

$17x = 101$

$x = \dfrac{101}{17}$

$y = 5 \times \dfrac{101}{17} - 14$

to

$y = x - 4$

$y = 5x - 14$

$x - 4 = 5x - 14$

$-4 = 4x - 14$

$4x = 10$

$x = \frac{10}{4}$

sub $\frac{10}{4}$ into $y = x - 4$

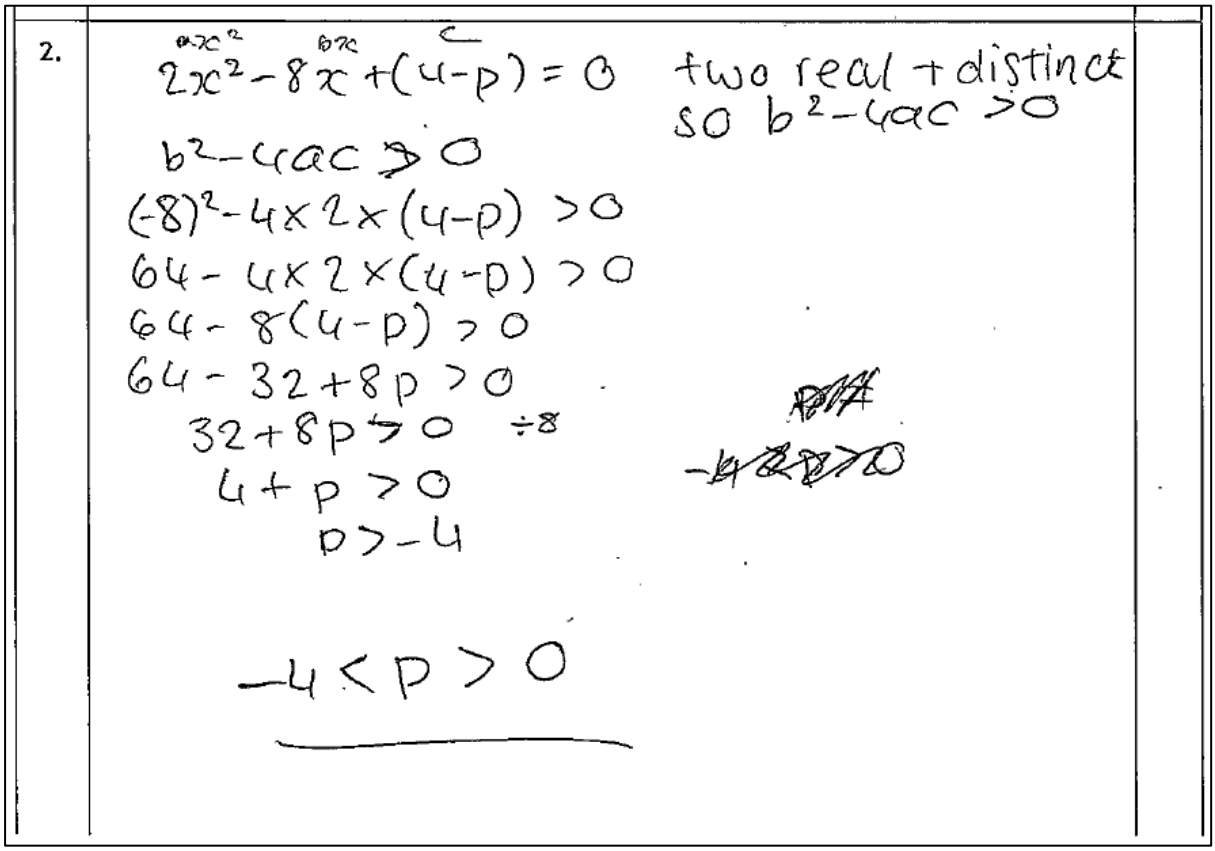
$y = \frac{10}{4} - 4$

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

POI $\left(\frac{10}{4}, -\frac{3}{2}\right)$

DO NOT WRITE IN THIS MARGIN

Candidate 2



2.

$2x^2 - 8x + (4-p) = 0$ (a = $2x^2$, b = $8x$, c)

two real + distinct
so $b^2 - 4ac > 0$

$b^2 - 4ac > 0$

$(-8)^2 - 4 \times 2 \times (4-p) > 0$

$64 - 4 \times 2 \times (4-p) > 0$

$64 - 8(4-p) > 0$

$64 - 32 + 8p > 0$

$32 + 8p > 0 \quad \div 8$

$4 + p > 0$

$p > -4$

$-4 < p > 0$

Candidate 3

2.

$2x^2 - 8x + (4-p) \geq 0$

$a = 2$
$b = -8$
$c = (4-p)$

$b^2 - 4ac \geq 0$

$(-8)^2 - 4 \times 2 \times (4-p)$

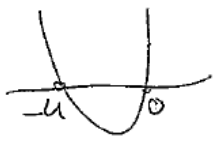
$64 - 8(4-p) \geq 0$

$= 64 - 32 + 8p \geq 0$

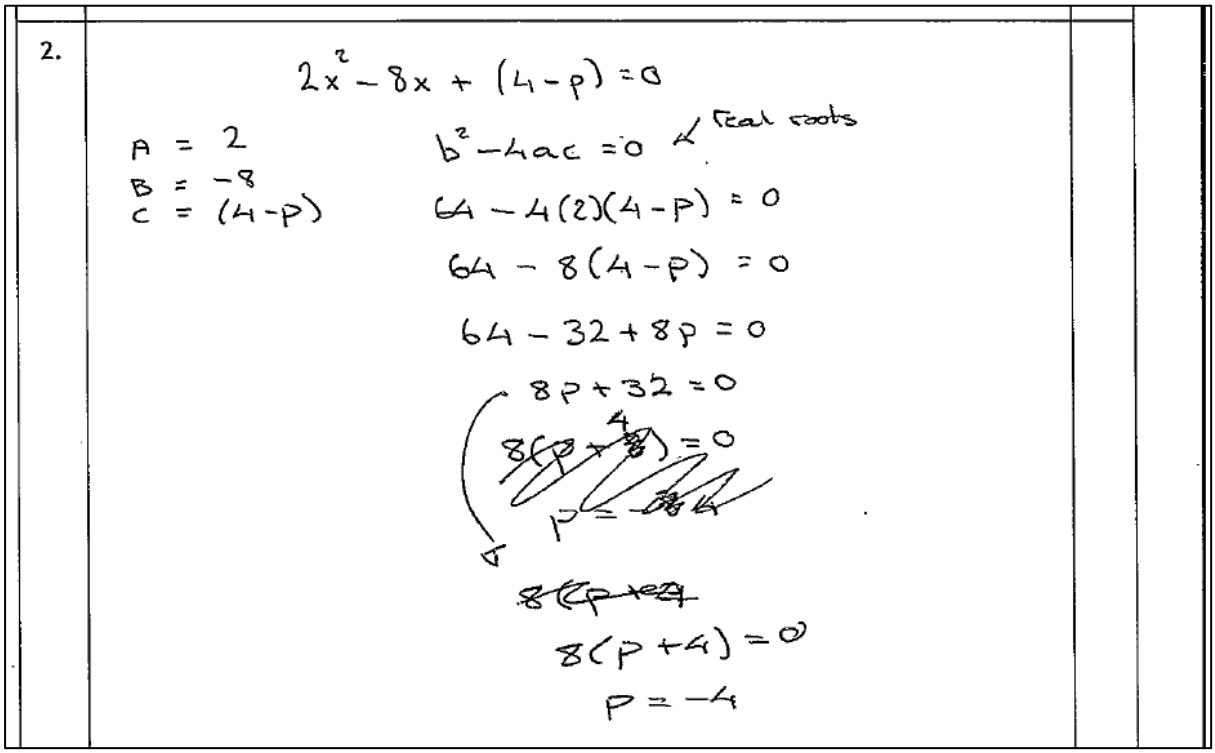
$8p + 32 \geq 0$

$8(p+4) \geq 0$ $\quad 0 \geq p \geq -4$

$p \geq 0$ $p \geq -4$



Candidate 4


2.
$2x^2 - 8x + (4-p) = 0$
A = 2
B = −8
C = (4−p)
$b^2 - 4ac = 0$ ✓ real roots
$64 - 4(2)(4-p) = 0$
$64 - 8(4-p) = 0$
$64 - 32 + 8p = 0$
$8p + 32 = 0$
$8(p+4) = 0$
$p = -4$

Candidate 5

QUESTION NUMBER

3.(a)

$4\sin x + 5\cos x = k\sin(x+a)$

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

$4\sin x + 5\cos x = k\cos a\sin x + k\sin a\cos x$

$k\cos a = 4$

$k\sin a = 5$

	S ✓	A ✓
T		C ✓

∴ Acute

$k = \sqrt{4^2+5^2}$

$= \sqrt{41}$

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

$a = \tan^{-1}\left(\frac{5}{4}\right)$

$= 51.340\ldots$

$= 51.3°$

∴ $4\sin x + 5\cos x = \sqrt{41}\sin(x+51.3)°$

DO NOT WRITE IN THIS MARGIN

3.(b)

$4\sin x + 5\cos x = 5.5$

$\sqrt{41}\sin(x+51.3) = 5.5$

$\sin(x+51.3) = \frac{5.5}{\sqrt{41}}$

AA: $\sin^{-1}\left(\frac{5.5}{\sqrt{41}}\right)$

$= 59.199\ldots$

$= 59.2$

	S ✓	A ✓
+		C

$x + 51.3 = 59.2, 120.8$ (−51.3, −51.3)

$x = 7.9, 69.5$

$= \frac{7.9\pi}{180}, \frac{69.5\pi}{180}$ $x = 0.137, 1.21\ldots$

$x = 0.1, 1.2$

Candidate 6

QUESTION NUMBER

4.(a) $\int_2^{-1} (x^3 - 5x^2 + 2x + 8)$

DO NOT WRITE IN THIS MARGIN

$$\int_2^{-1} \left[\frac{x^4}{4} - \frac{5x^3}{3} + \frac{2x^2}{2} + 8x\right]$$

$$\left(\frac{(-1)^4}{4} - \frac{5(-1)^3}{3} + \frac{2(-1)^2}{2} + 8(-1)\right)$$

$$\left[-1 + \frac{5}{3} + \frac{2}{2} - 8\right]$$

$$\frac{-19}{3}$$

$$\left[\frac{(2)^4}{4} - \frac{5(2)^3}{3} + \frac{2(2)^2}{2} + 8(2)\right]$$

$$\frac{16}{4} - \frac{40}{3} + \frac{8}{2} + 16$$

$$4 - \frac{40}{3} + 4 + 16$$

$$= \frac{32}{3}$$

$$\frac{-19}{3} - \frac{32}{3} = -17 \text{ units}^2.$$

Candidate 7

QUESTION NUMBER

4.(a)

DO NOT WRITE IN THIS MARGIN

$y = x^3 - 5x^2 + 2x + 8$

$\int_{-1}^{2} (x^3 - 5x^2 + 2x + 8)$

$\int_{-1}^{2} \left(\frac{x^4}{4} - \frac{5x^3}{3} + \frac{2x^2}{2} + 8x\right) + C$

$\int \left(\frac{(2)^4}{4} - \frac{5(2)^3}{3} + (2)^2 + 8(2)\right) -$

$\left(\frac{(-1^4)}{4} - 5\frac{(-1^3)}{3} + (-1)^2 + 8(-1)\right)$

$\int = \frac{32}{3} - \left(-\frac{91}{12}\right)$

$= \frac{32}{3} + \frac{91}{12}$

$= \frac{73}{4}$ sq units.

QUESTION NUMBER

4.(b)

DO NOT WRITE IN THIS MARGIN

$\frac{73}{4}$ sq units

$$\int_2^4 \left(\frac{x^4}{4} - \frac{5x^3}{3} + x^2 + 8x\right) + C$$

$$\left(\frac{(4^4)}{4} - \frac{5(4^3)}{3} + (4^2) + 8(4)\right) -$$

$$\left(\frac{(2^4)}{4} - \frac{5(2^3)}{3} + (2^2) + 8(2)\right)$$

$$= \frac{16}{3} - \frac{32}{3}$$

$$= \frac{-16}{3}$$

let $\frac{-16}{3} = \frac{16}{3}$ sq units

Total shaded area $= \frac{73}{4} + \frac{16}{3}$

$= \frac{283}{12}$ sq units

Candidate 8

QUESTION NUMBER | WRITE IN THIS MARGIN

5.(a) (i)

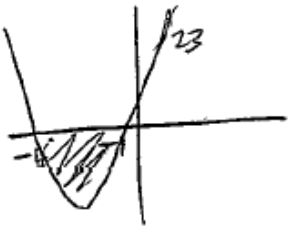
$f(g(x))$
$= f(3x+5)$
$= (3x+5)^2 - 2$
$= 9x^2+30x+25-2$
$= 9x^2+30x+23$

5.(a) (ii)

$g(f(x))$
$= g(x^2-2)$
$= 3(x^2-2)+5$
$= 3x^2-6+5$
$= 3x^2-1$

5.(b)

$9x^2+30x+23 < 3x^2-1$
$6x^2+30x+24 = 0$
$6(x^2+5x+4) = 0$
$6(x+1)(x+4) = 0$
$x+1=0 \quad x+4=0$
$\therefore x=-1 \quad x=-4$



When $-4 < x < -1$

Candidate 9

QUESTION NUMBER | DO NOT WRITE IN THIS MARGIN

5.(a) (i)

$f(x) = x^2 - 2 \qquad g(x) = 3x + 5$

$f(g(x))$

$= f(3x+5)$

$= (3x+5)^2 + 2$

$= (3x+5)(3x+5) + 2$

$= 9x^2 + 30x + 25 + 2$

$= 9x^2 + 30x + 27$

5.(a) (ii)

$g(f(x))$

$= g(x^2 - 2)$

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

$= 3x^2 - 6 + 5$

$= 3x^2 - 1$

5.(b)

$9x^2 + 30x + 27 < 3x^2 - 1$

$12x^2 + 30x + 26 = 0$

$2(6x^2 + 15x + 13) = 0$

$2(6x \quad)(x \quad) = 0$

$9x^2 + 30x + 27 < 3x^2 - 1$

$6x^2 + 30x + 28 < 0$

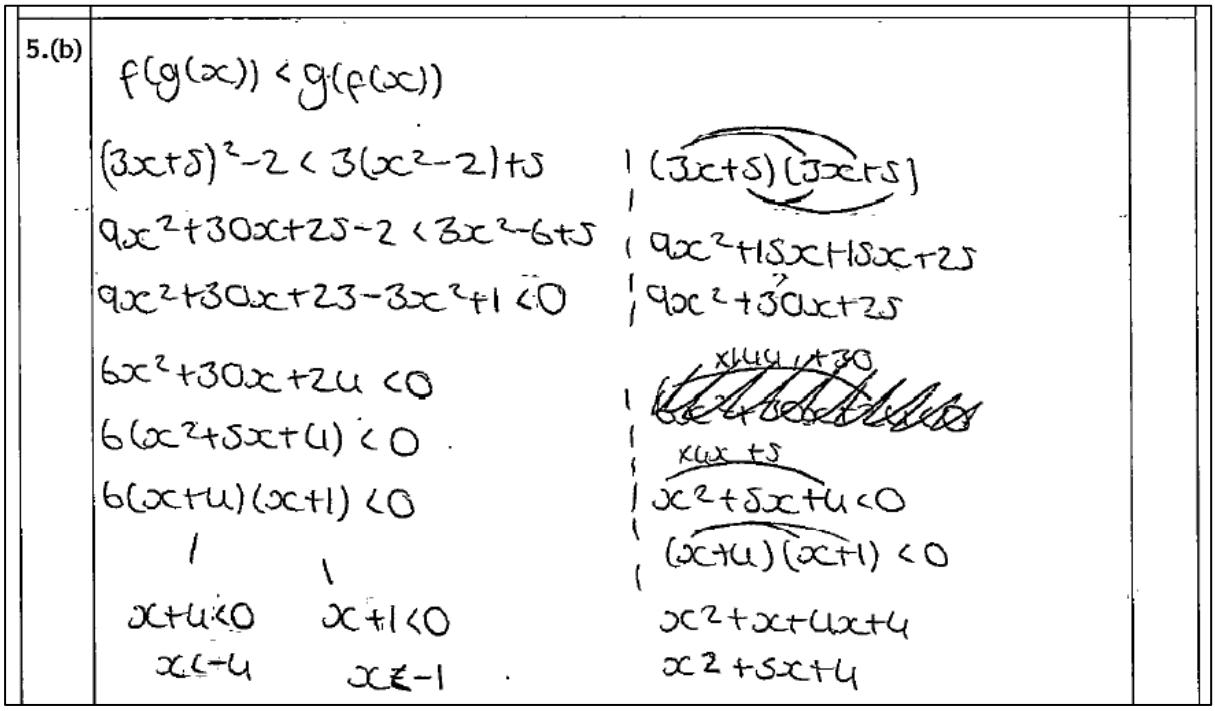
$2(x^2 + 15x + 14) < 0$

$2(x \quad)(x \quad) < 0$

$2(3x^2 + 15x + 14) < 0$

$2(3x - 2)(x + 7) < 0$

Candidate 10



Candidate 11

5.(b)

$f(g(x)) < g(f(x))$

$f(3x+5) < g(x^2-2)$

$(3x+5)^2 - 2 < 3(x^2-2)+5$

$(3x+5)(3x+5) - 2 < 3(x^2-2)+5$

$3x^2+15x+15x+25-2 < 3x^2-6+5$

$3x^2+30x+23 < 3x^2-1$

$3x^2+30x+23-3x^2+1 < 0$

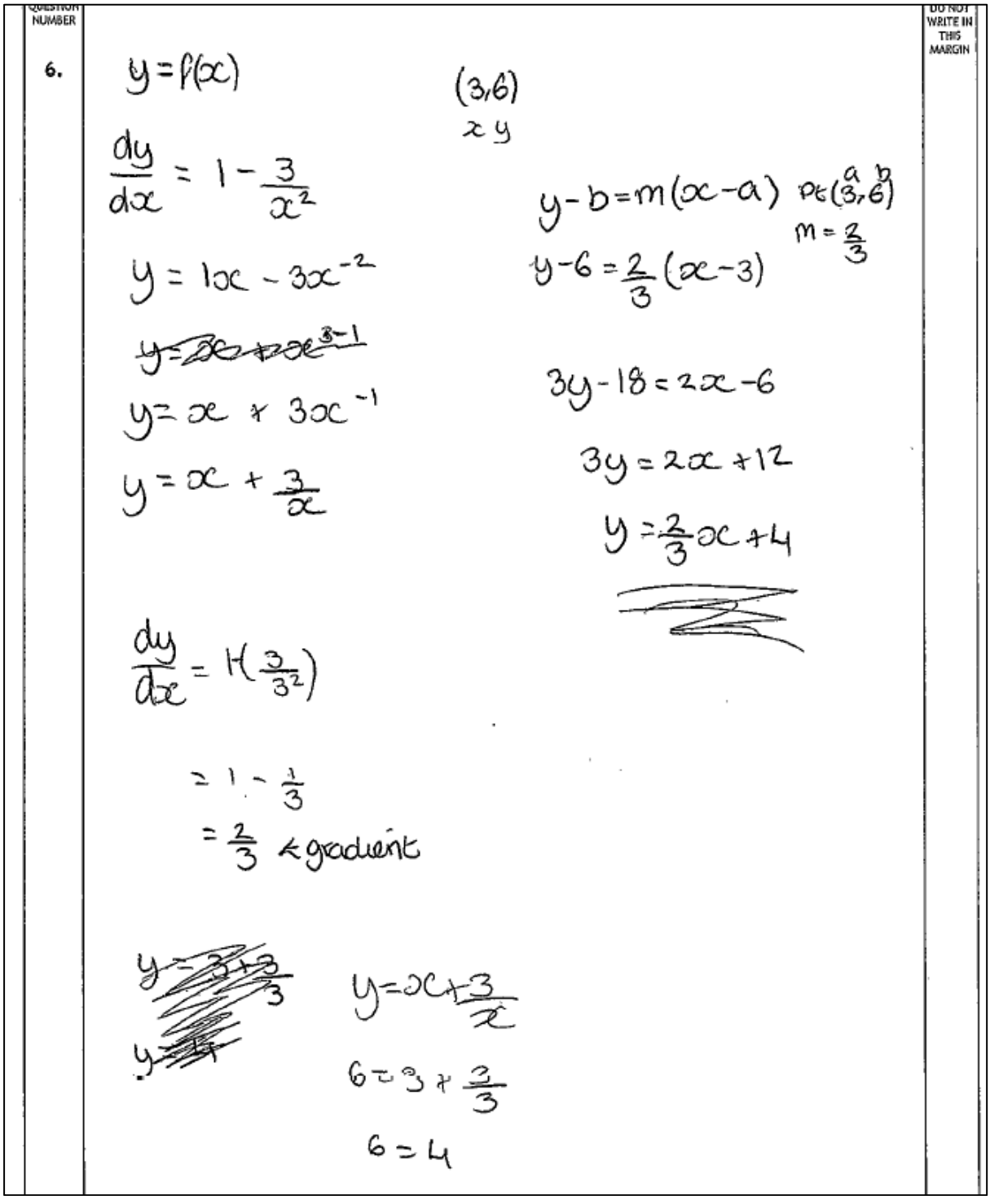
$30x+24 < 0$

$30x < 24$

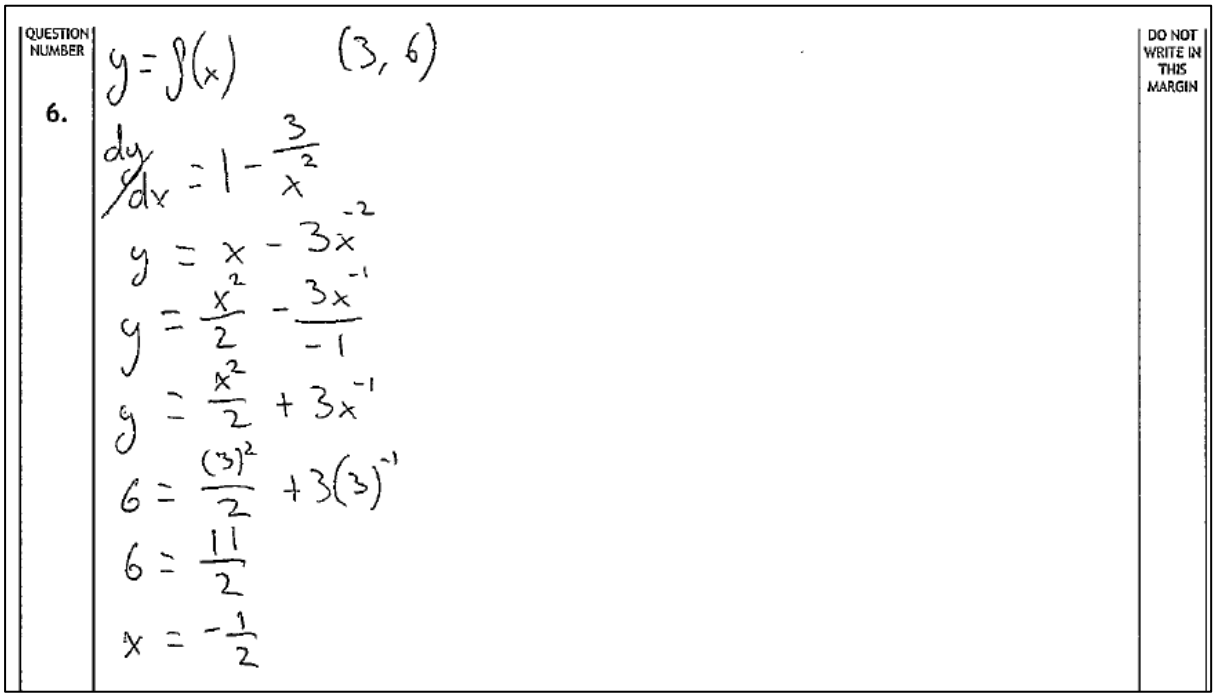
$x < \frac{24}{30}$

$x > \frac{1}{5}$

Candidate 12



Candidate 13



Candidate 14

QUESTION NUMBER

6.

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

$y = 2x^2 +$

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

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

$$1 - \frac{3}{x^2} = 0$$

$$-\frac{3}{x^2} = -1$$

$$\frac{3}{x^2} = 1$$

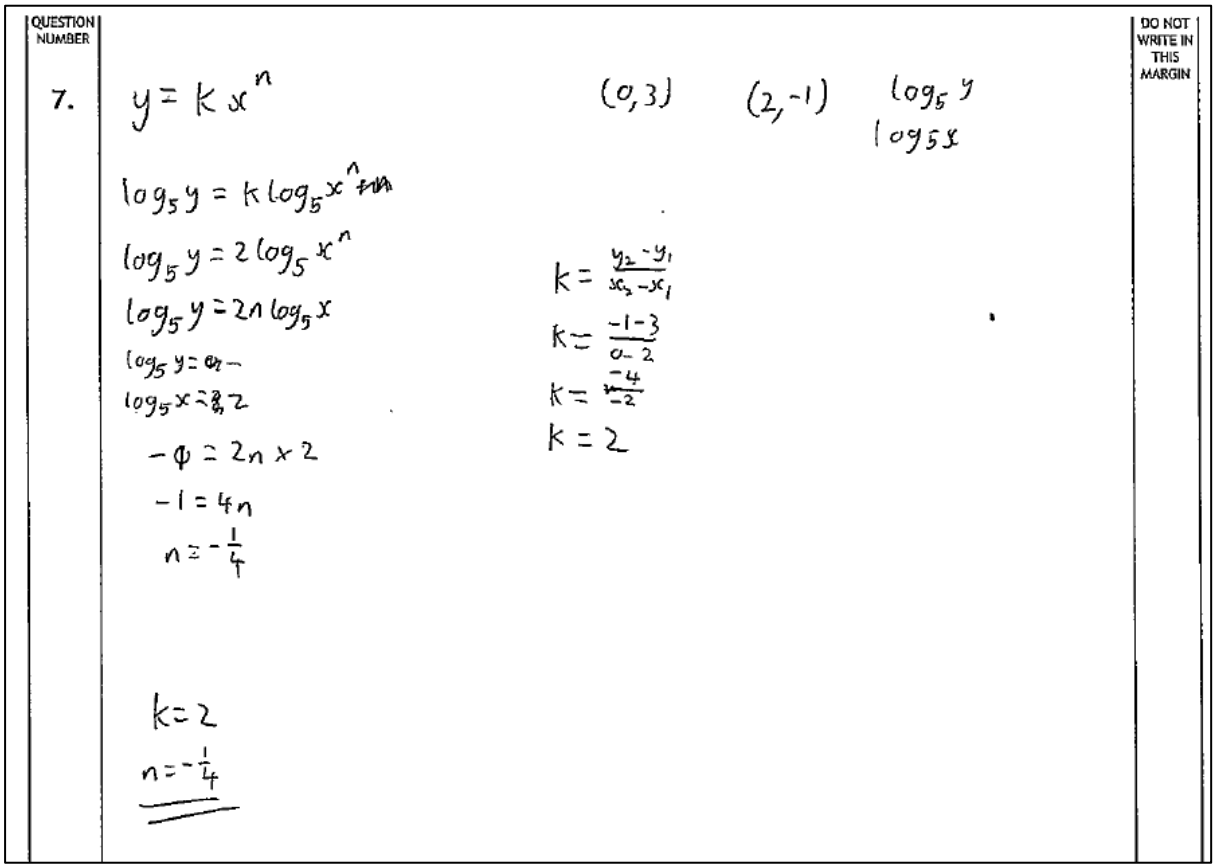
$$3 = x^2$$

$$x = \sqrt{3}$$

$$\sqrt{3} - \frac{3\sqrt{3}^{-1}}{-1}$$

DO NOT WRITE IN THIS MARGIN

Candidate 15



QUESTION NUMBER

7. $y = kx^n$

$\log_5 y = k \log_5 x^n$ FAIL

$\log_5 y = 2 \log_5 x^n$

$\log_5 y = 2n \log_5 x$

$\log_5 y = 0x -$

$\log_5 x = 2, 2$

$-0 = 2n \times 2$

$-1 = 4n$

$n = -\frac{1}{4}$

$k = 2$

$n = -\frac{1}{4}$

(0, 3) (2, -1) $\log_5 y$ $\log_5 x$

$k = \frac{y_2 - y_1}{x_2 - x_1}$

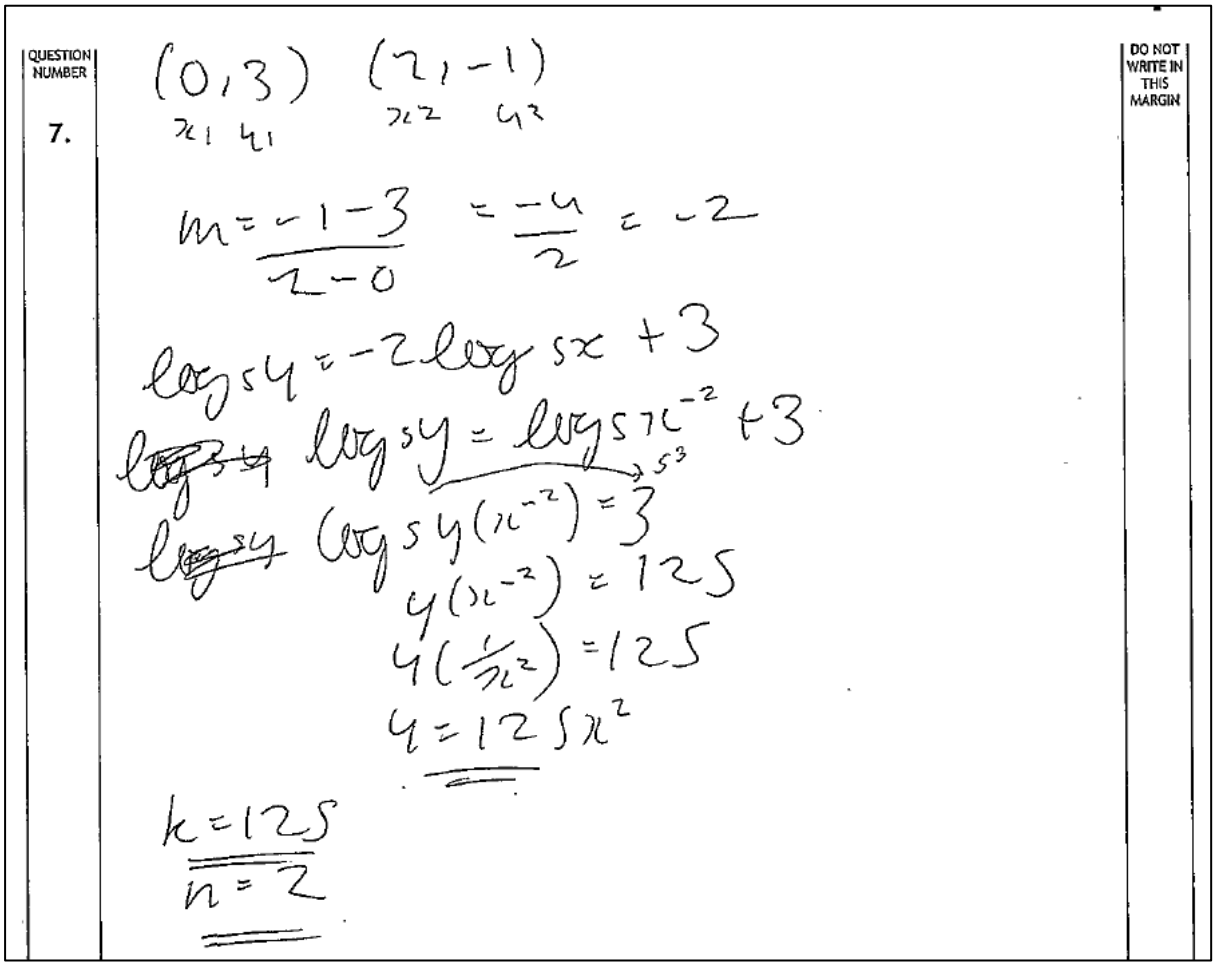
$k = \frac{-1-3}{0-2}$

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

$k = 2$

DO NOT WRITE IN THIS MARGIN

Candidate 16



QUESTION NUMBER 7.

DO NOT WRITE IN THIS MARGIN

$(0,3)$ $(2,-1)$
x_1 y_1 x_2 y_2

$m = \frac{-1-3}{2-0} = \frac{-4}{2} = -2$

$\log_5 y = -2\log_5 x + 3$

$\log_5 y = \log_5 x^{-2} + 3$

$\log_5 y = \log_5 x^{-2} + \log_5 5^3$

$\log_5 y(x^{-2}) = 3$

$y(x^{-2}) = 125$

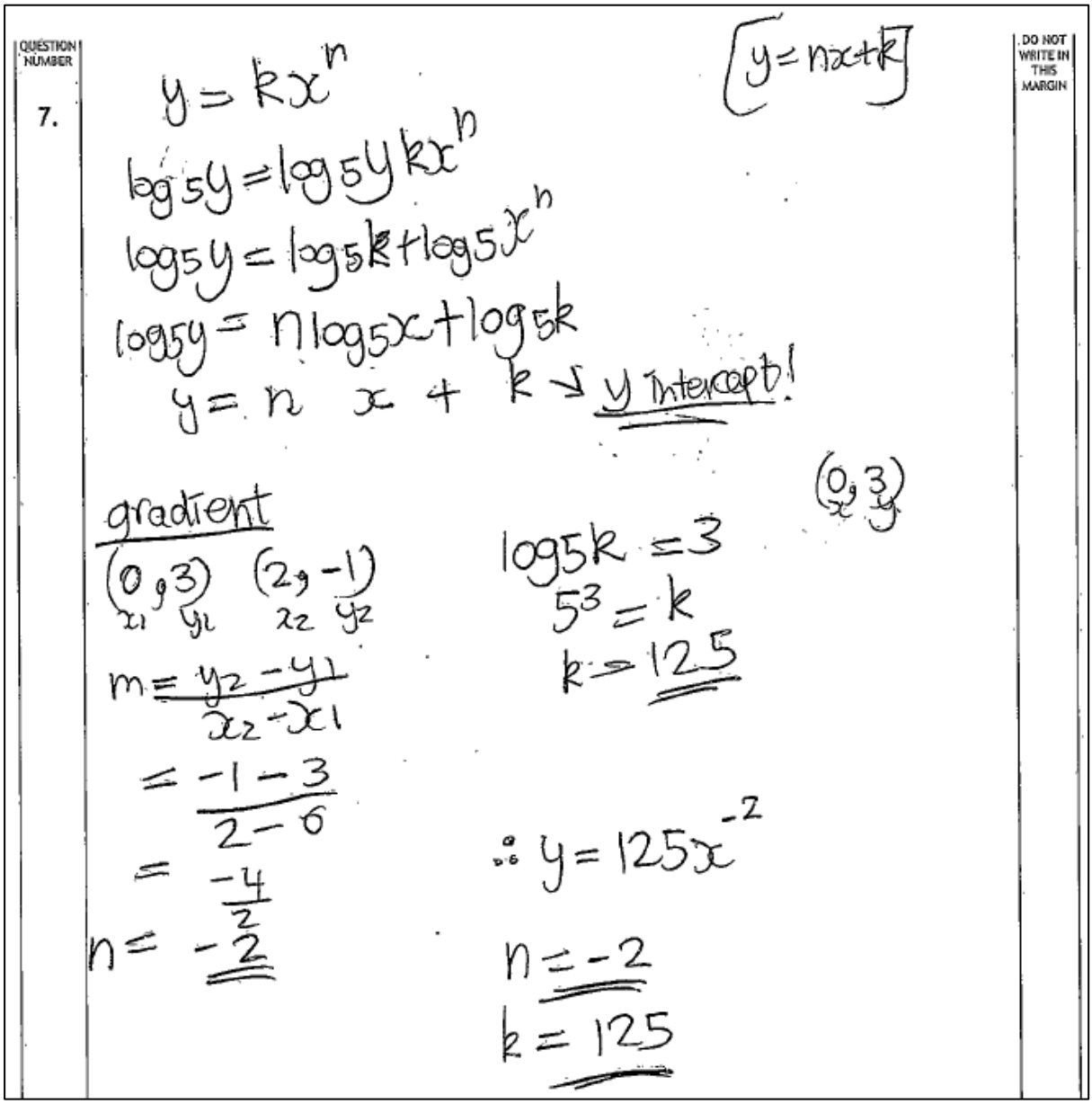
$y\left(\frac{1}{x^2}\right) = 125$

$y = 125x^2$

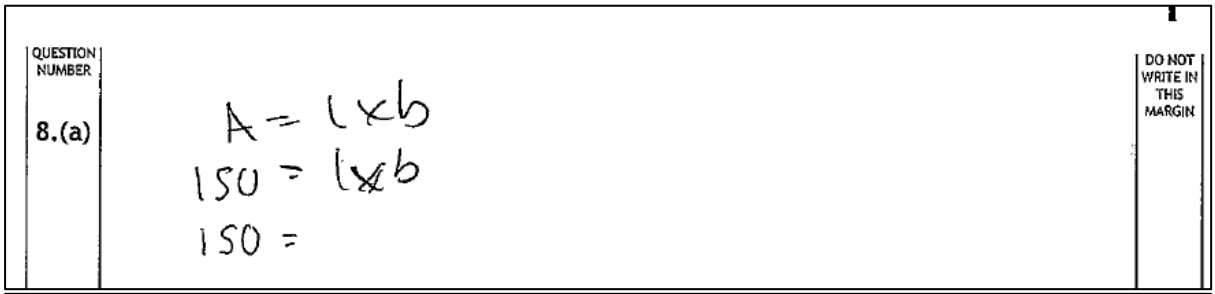
$k = 125$

$n = 2$

Candidate 17



Candidate 18



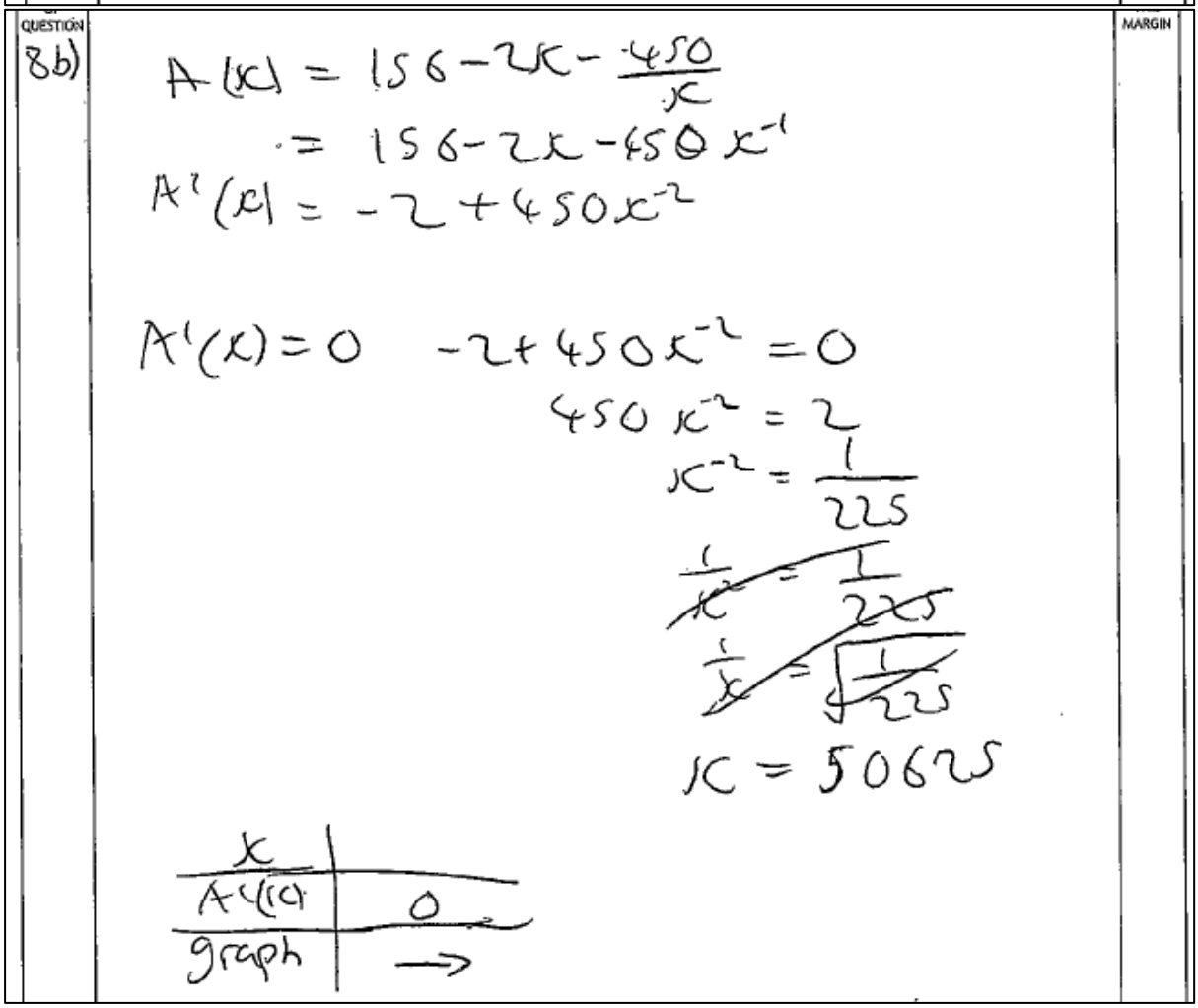
QUESTION NUMBER 8.(a)

DO NOT WRITE IN THIS MARGIN

$A = l \times b$

$150 = l \times b$

$150 =$



QUESTION 8b)

MARGIN

$A(x) = 156 - 2x - \frac{450}{x}$

$= 156 - 2x - 450x^{-1}$

$A'(x) = -2 + 450x^{-2}$

$A'(x) = 0 \quad -2 + 450x^{-2} = 0$

$450x^{-2} = 2$

$x^{-2} = \frac{1}{225}$

$\frac{1}{x^2} = \frac{1}{225}$

$\frac{1}{x} = \sqrt{\frac{1}{225}}$

$x = 50625$

x	
$A'(x)$	0
graph	→

Candidate 19

QUESTION NUMBER

8.(b)

DO NOT WRITE IN THIS MARGIN

$A(x) = 156 - 2x - \frac{450}{x}$

$= 156 - 2x - 450x^{-1}$

$A'(x) = -2 + 450x^{-2}$

for stationary points $A'(x) = 0$

$-2 + 450x^{-2} = 0$

$450x^{-2} = 2$

$x^{-2} = 225$

$x = 15, -15$

$A'(x)$	$\to$ 15 $\to$ 16
	+ 0 −
	/ − \

Max Ty when $x = 15$

$A'(x)$	$\to$ −15 $\to$ 1
	− 0 +
	\ _ /

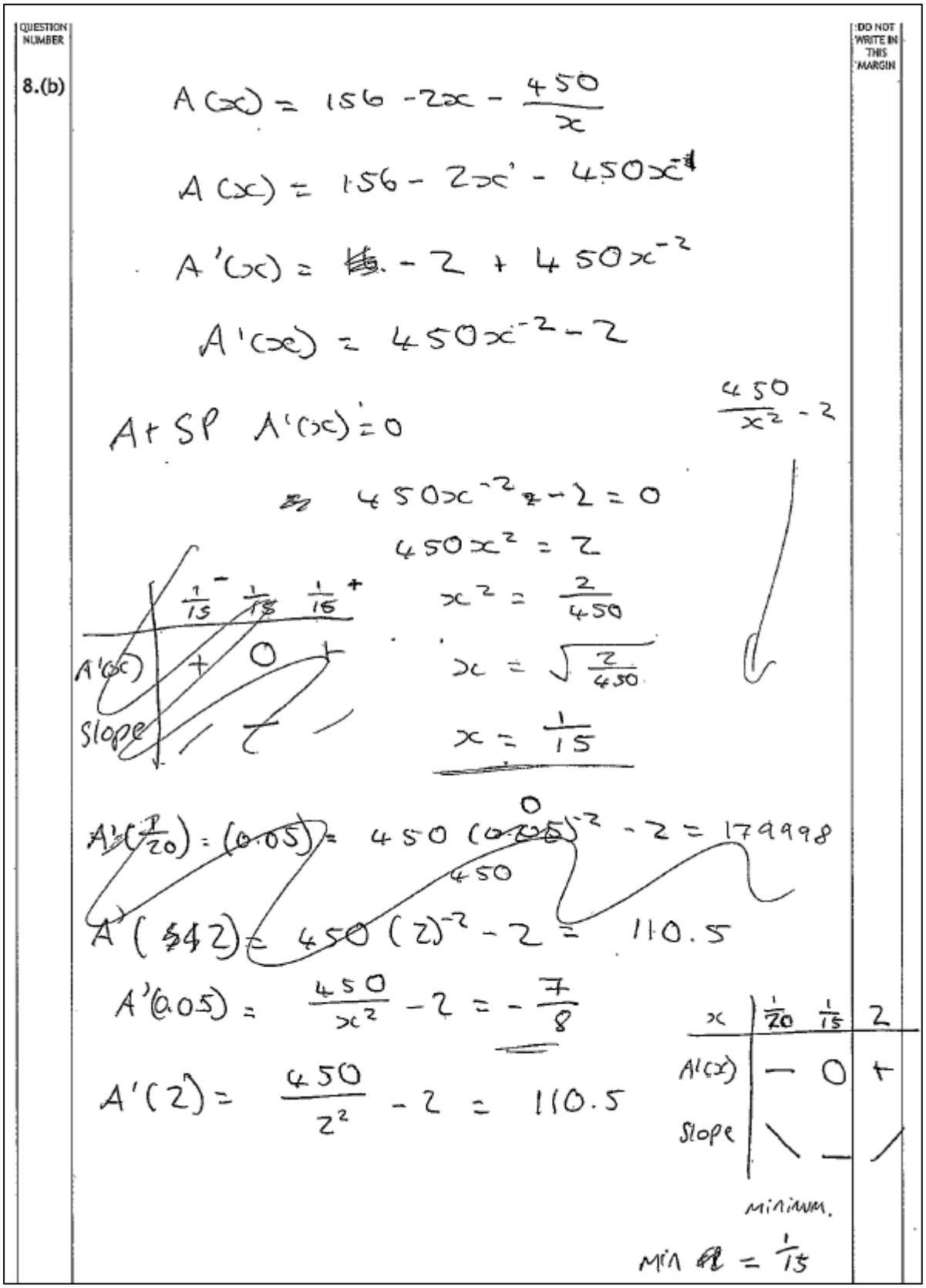
Min Ty when $x = -15$

$A(15) = 156 - 2 \times 15 - \frac{450}{15}$

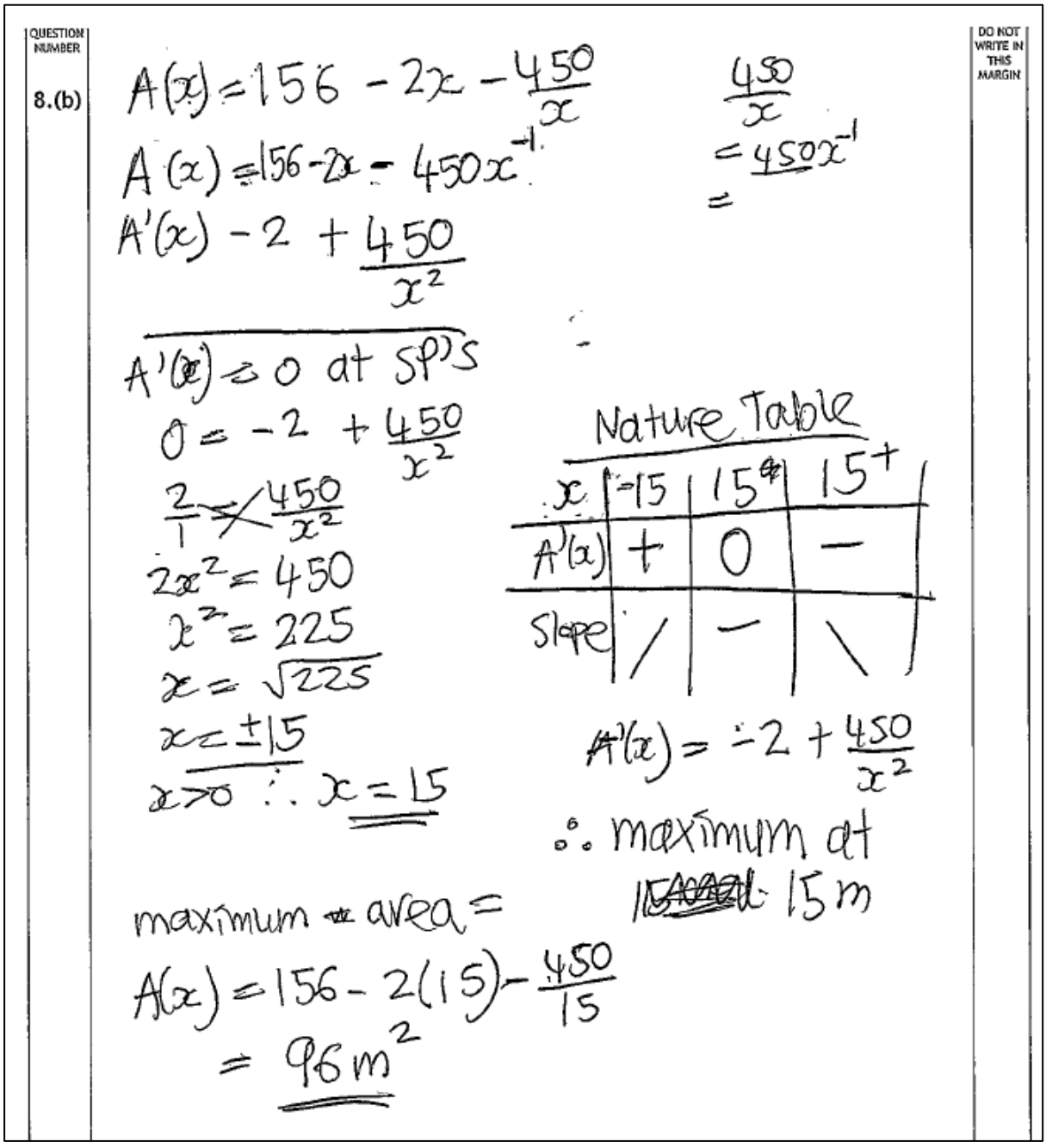
$= 96$

Max area of the Pond is $96m^2$

Candidate 20



Candidate 21



QUESTION NUMBER

8.(b)

DO NOT WRITE IN THIS MARGIN

$A(x) = 156 - 2x - \frac{450}{x}$

$A(x) = 156 - 2x - 450x^{-1}$

$A'(x) = -2 + \frac{450}{x^2}$

$\frac{450}{x} = 450x^{-1}$

$A'(x) = 0$ at SP's

$0 = -2 + \frac{450}{x^2}$

$\frac{2}{1} = \frac{450}{x^2}$

$2x^2 = 450$

$x^2 = 225$

$x = \sqrt{225}$

$x = \pm 15$

$x > 0 \therefore x = 15$

Nature Table

x	-15	15^-	15^+
$A'(x)$	+	0	−
Slope	/	−	\

$A'(x) = -2 + \frac{450}{x^2}$

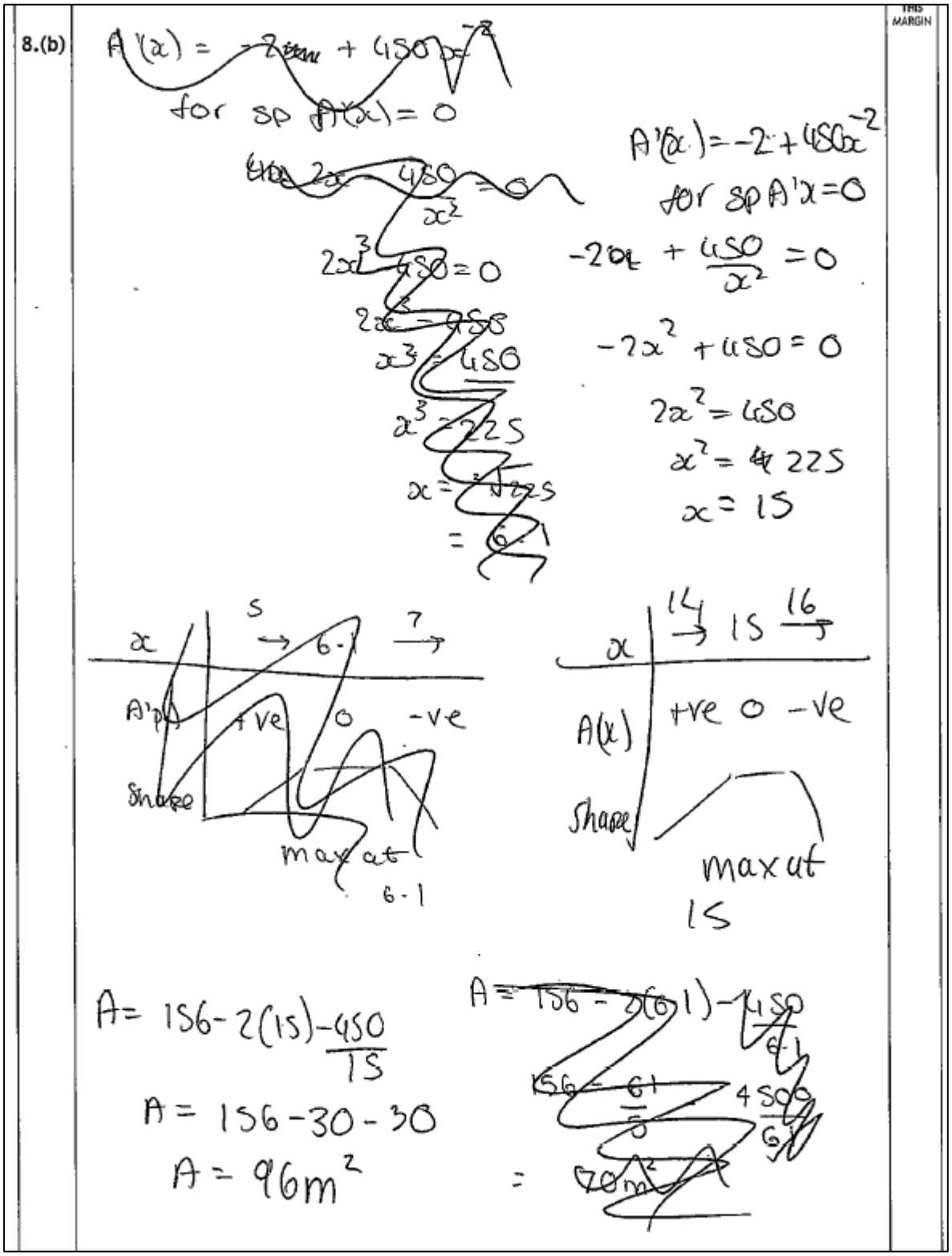
$\therefore$ maximum at 15 m

maximum area =

$A(x) = 156 - 2(15) - \frac{450}{15}$

$= 96\,m^2$

Candidate 22



Candidate 23

QUESTION NUMBER

9.(a)

DO NOT WRITE IN THIS MARGIN

$x^2+y^2-4x-6y-7=0$

$x^2+(3x+7)^2-4x-6(3x+7)-7=0$

$x^2+9x^2+42x+49-4x-18x-42-7=0$

$10x^2+20x$

$10(x^2+2)=0$

$(x+1)(x+1)=0$

$x=-1 \quad x=-1$

$y=3(-1)+7 \quad y=3(-1)+7$

$=4 \quad =4$

$(-1,4) \quad (-1,4)$

QUESTION NUMBER

9.(b)

$x^2 + y^2 - 4x - 6y - 7 = 0$

$x^2 + y^2 + 2gx + 2fy + c = 0$

$c = -7$

$2g = -4 \quad 2f = -6$

$g = -2 \quad f = -3$

centre $= (-g, -f) = (2, 3)$

$\text{radius} = \sqrt{g^2 + f^2 - c}$

$= \sqrt{(-2)^2 + (-3)^2 + 7}$

$= \sqrt{4 + 9 + 7}$

$= \sqrt{20}$

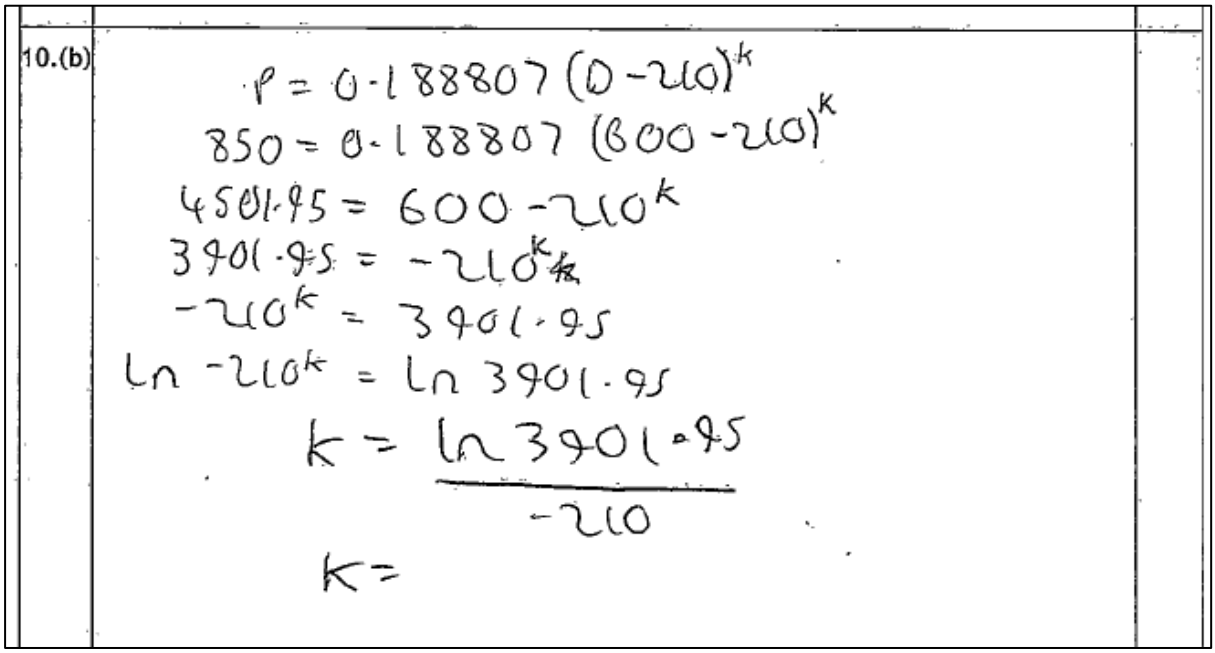
$\text{equation} = (x + 2)^2 (x + 3)^2 = \sqrt{20}$

DO NOT WRITE IN THIS MARGIN

Candidate 24

10.(a)	$P = 4 \cdot 99087(42 \cdot 5 - t)^{1 \cdot 81}$ $P = 4 \cdot 99087(42 \cdot 5 - 24 \cdot 55)^{1 \cdot 81}$ $P = 4 \cdot 99087(17 \cdot 95)^{1 \cdot 81}$ $P = 89 \cdot 88\ldots^{1 \cdot 81}$ $P = 6 \cdot 11$	THIS MARGIN
10.(b)	$P = 0 \cdot 188807(D - 210)^K$ $850 = 0 \cdot 188807(600 - 210)^K$ $850 = 0 \cdot 188807(390)^K$ $850 = 73 \cdot 35^K$ $6 \cdot 745 = 73 \cdot 35$ $K = 66 \cdot 605$ $K = 6 \cdot 745$	

Candidate 25



Candidate 26

QUESTION NUMBER		DO NOT WRITE IN THIS MARGIN
10.(a)	$P=4.99087(42.3-T)^{1.81}$ $P=4.99087(42.5-24.55)^{1.81}$ $P=4.99087(17.95)^{1.81}$ $P=4.99087(186.1472651)$ $P=929$ points	
10.(b)	$P=0.188807(D-210)^{k}$ $850=0.188807(600-210)^{k}$ $850=0.188807(390)^{k}$ $\frac{850}{0.188807}=(390)^{k}$ $4501.951728=(390)^{k}$	