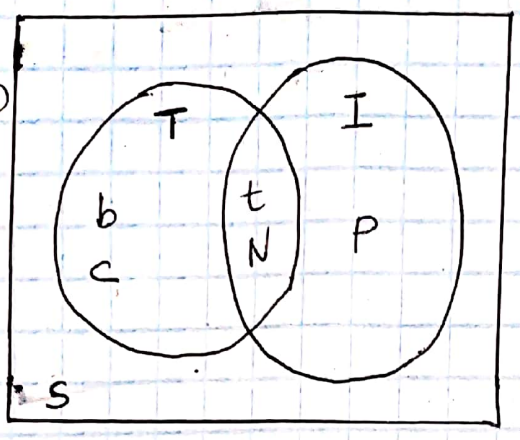
Question 1

(a)



where:

t → Tony
b → Bruce
N → Natasha
C → Clint
P → Peter
S → Steve

T → Twitter
I → Instagram

(b) $I' = \{Bruce, Clint, Steve\}$

(c) $T \cap I = \{Tony, Natasha\}$

Question 2

Data: 11, 14, 11, 15, 11, 17, 18

Mean: $\frac{\Sigma x_i}{n} = \frac{97}{7} = 13.86$

Median = $\left(\frac{7+1}{2}\right) = 4^{th}$ Value

$= 14$

Question 3

$f: x \longrightarrow 7x - 3$; $f(x) = 7x - 3$

$f^{-1} \rightarrow ?$

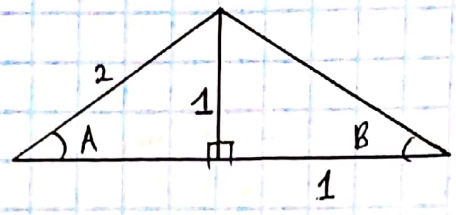
Let $y = 7x - 3$

$7x = y - 3$

$x = \frac{y-3}{7}$

$f^{-1}(x) = \frac{x-3}{7}$

Question 4



$\tan B = \frac{1}{1}$

$B = \tan^{-1}(1) = 45°$

$\sin A = 1/2$

$A = \sin^{-1}(0.5)$

$= 30°$

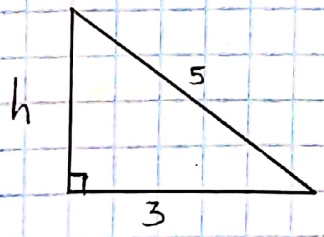
Question 5

Colours : Space Grey, Gold, Silver ...(3)
Speeds: 1.6, 1.8 ....(2)
Storage: 128, 256 ... (2)

$n = 3 \times 2 \times 2 = 12$

= 12 different configurations

Question 6



From Pythagoras theorem:

$a^2 + b^2 = c^2$

$5^2 = 3^2 + h^2$

$25 = 9 + h^2$

$h^2 = 16$

$h = \pm 4$; $h = |\sqrt{16}|$

$h = 4$

Question 7

$V = u + at$

$V - u = at$; $t = \frac{V-u}{a}$

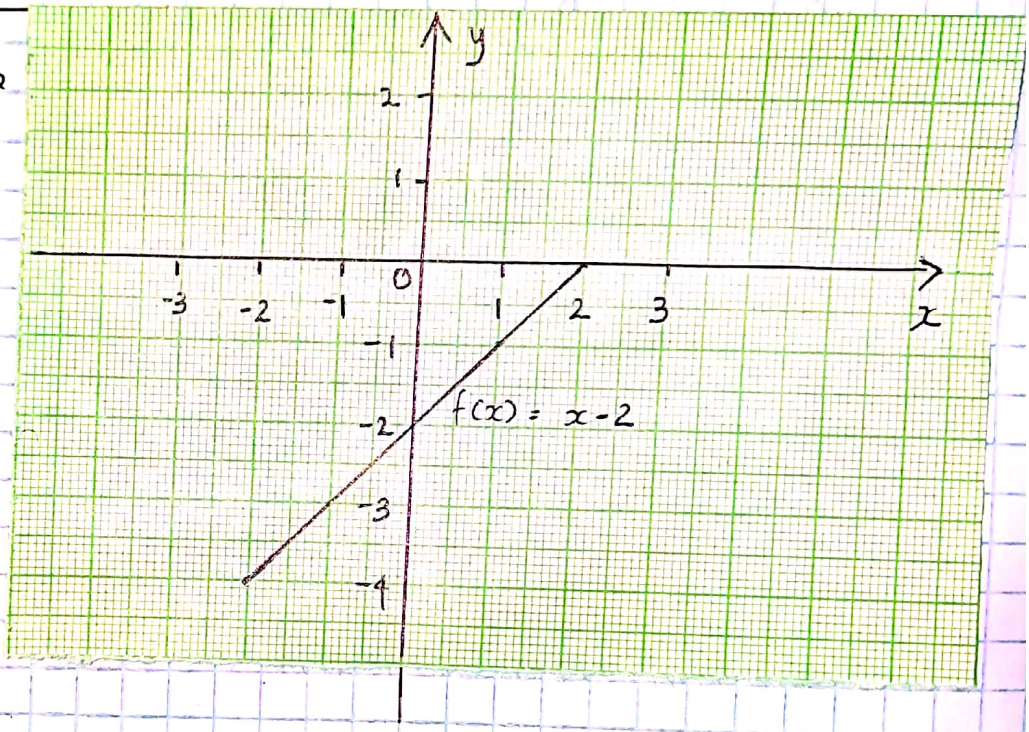
Question 8

(a) Continuous
(b) Discrete
(c) Continuous
(d) Discrete

Question 9

$f(x) = x - 2 \; ; \; -2 \leq x \leq 2$

x	$f(x)$
-2	-4
-1	-3
0	-2
1	-1
2	0



Question 10

Array: 2, 4, 5, 8, 10 ; n = 6

(a) $5 \times 5 \times 4 \times 3 \times 2$

$= 600$

(b) For the numbers to be odd, the last digit must be 5

$= 3 \times 3 \times 2$

$= 6 \times 3$

$= 18$

Question 11

$Z^2 - 4Z + 13 = 0$ Let Z be x

Rewrite: $x^2 - 4x + 13 = 0$

Using the quadratic formula:

$$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a} \quad \text{where} \quad ax^2 + bx + c = 0$$

$$x = \frac{+4 \pm \sqrt{16 - 4 \times 13}}{2 \times 1}$$

$$x = \frac{4 \pm \sqrt{-36}}{2} \quad ; \quad \sqrt{-36} = 6i$$

$$x = 2 + 3i, \quad x = 2 - 3i$$

Thus $Z = 2 + 3i$, $Z = 2 - 3i$

Question 12

$4(3-4)(7-9) \div 2 + 4^2$

Brackets: $4(-1)(-2) \div 2 + 4^2$

Division: $\frac{8}{2} + 4^2$; $4 + 4^2$

Multiplication: $4 + 4 \times 4$; $4 + 16$

Addition: $4 + 16 = 2$

$= 20$

SECTION B

Question 1

(a) (i) P(black card)

$= \frac{13 \times 2}{52}$

$= \frac{1}{2}$

(ii) P(king)

$= \frac{4}{52} = \frac{1}{13}$

(iii) P(not a black card or king)

P(red) = $\frac{1}{2}$

P(king) = $\frac{1}{13}$

P(red and king) = $\frac{2}{52}$

$= \frac{1}{2} + \frac{1}{13} - \frac{2}{52}$

$= \frac{7}{13}$

(b) (i) Mutiple of 2

$\frac{9}{18} = \frac{1}{2}$

(ii) Multiple of 9

$= \frac{2}{18} = \frac{1}{9}$

(iii) Multiple of 2 and multiple of 9

$= \frac{1}{18}$

ie only 18 is a multiple of 2 and 9

(c) (i) 8 textbooks

$8!$

$= 40320$ ways

(ii) $n = 15$

$15C_4$

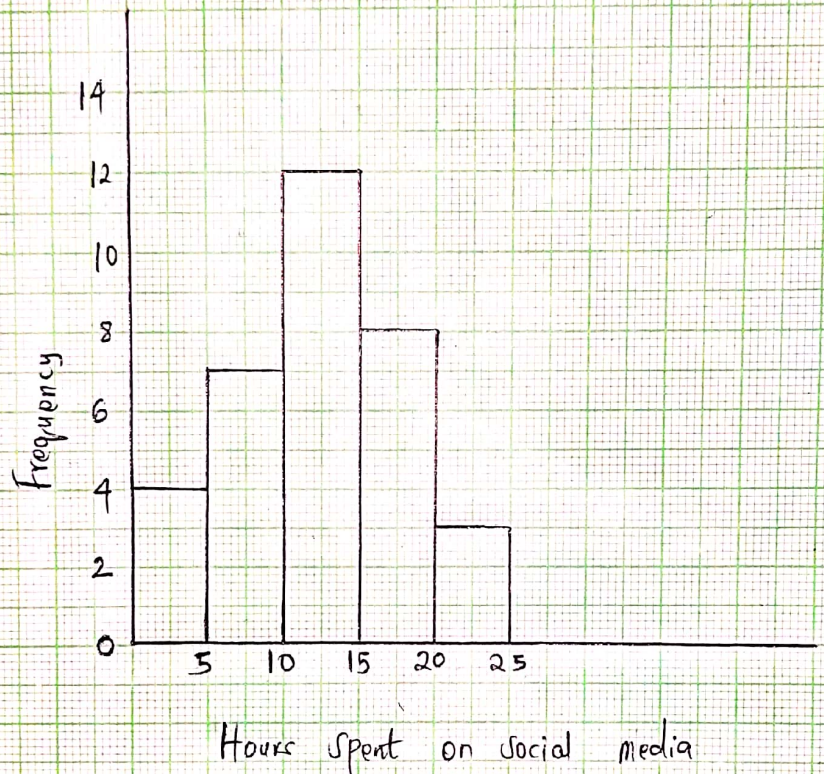
$= \frac{15!}{4!(11)!}$

$= 1365$ combinations.

Question 2

Hours spent on social Media	0-5	6-10	11-15	16-20	21-25
No. of students	4	7	12	8	3

(i) Histogram



(ii) The histogram displays a symmetrical distribution. The shape to the left and right of the middle vertical line are about the same.

(iii)

Hours Spent	f	Midpoint (x)	fx
0-5	4	2.5	10
6-10	7	8	56
11-15	12	13	156
16-20	8	18	144
21-25	3	23	69
	$\Sigma f = 34$		$\Sigma fx = 435$

$$\bar{x} = \frac{\Sigma fx}{n} = \frac{435}{34} = 12.79 \approx 13 \text{ hours}$$

(iv)

Modal number: Highest frequency = 12

Modal class: 11 - 15

(v) The mean hours spent on social media is 13 hours. The modal class is 11 - 15. The mean hours spent on social media lies in the modal class. ~~The modal~~ n

(vi) $M_m = L + \left[\frac{\frac{n}{2} - cf}{f}\right] h$

$\text{Median} = \left(\frac{34+1}{2}\right) = \frac{17^{th} + 18^{th}}{2}$

Hours spent	f	cf
0 - 5	4	4
6 - 10	7	11
11 - 15	12	23
16 - 20	8	31
21 - 25	3	34

The 17^{th} and 18^{th} value lie in the 3rd class.

Thus the medial lies in the interval: 11 - 15

Question 3

(a) (1, 1) b(5, 2) , c(6, 4) d(2, 3)

(i) Slope ab

$$= \frac{2-1}{5-1} = \frac{1}{4}$$

(ii) Slope bc

$$m_{bc} = \frac{4-2}{6-5} = 2$$

(iii) Length ab

$$L = \sqrt{(1-2)^2 + (1-5)^2}$$

$$= \sqrt{1+16} = \sqrt{17} \text{ units} \approx 4.12 \text{ units}$$

(iv) Midpoint bc

$$M = \left(\frac{5+6}{2}, \frac{2+4}{2}\right)$$

$$= (5.5, 3)$$

(v) $m_{ab} = 1/4$, $m_{cd} = \frac{3-4}{2-6} = \frac{-1}{-4} = \frac{1}{4}$

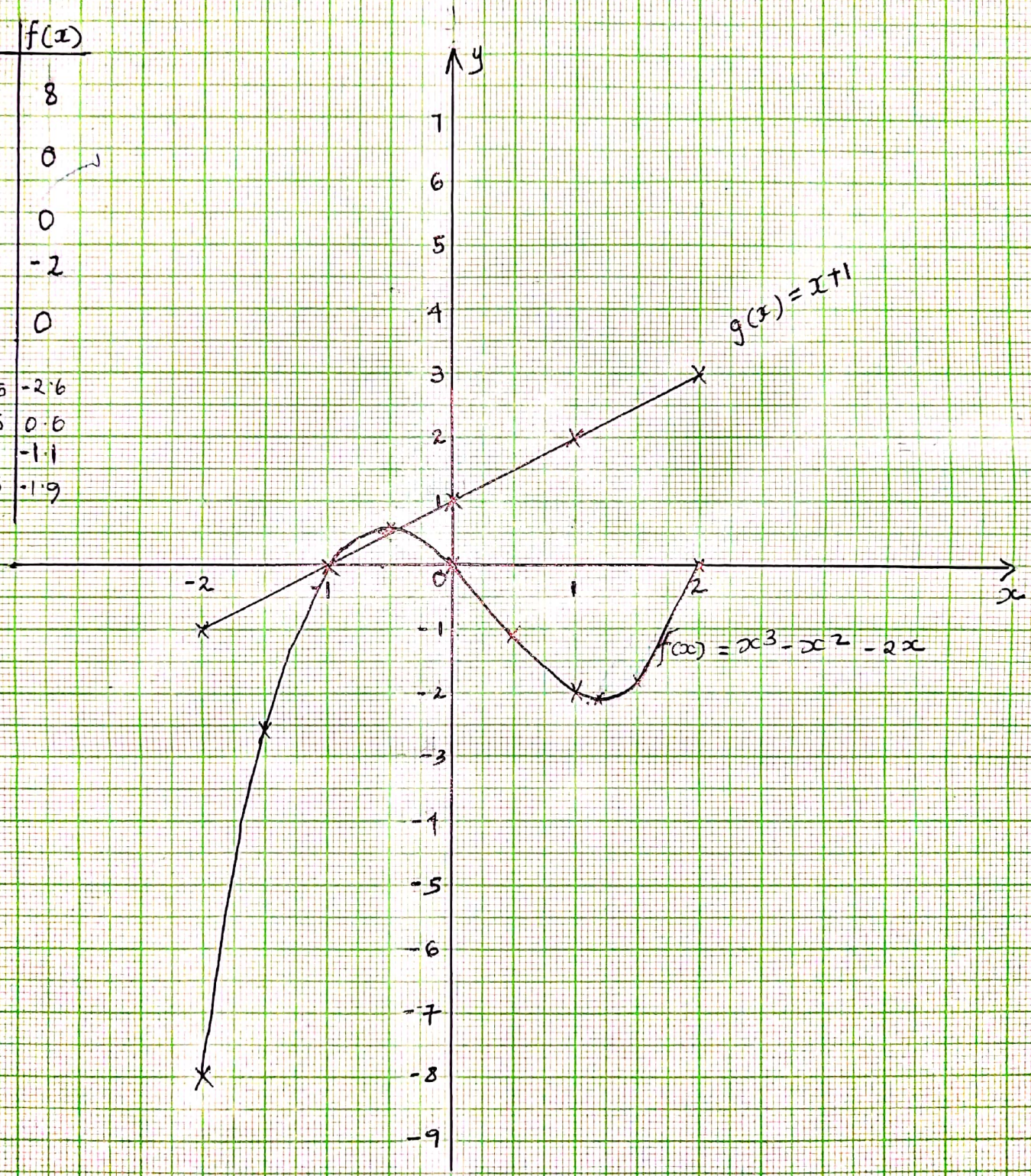
Line ab is ~~not~~ parallel to line cd. They have equal slopes.

Question 4.

$g(x) = x + 1$

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

x	$f(x)$
-2	8
-1	0
0	0
1	-2
2	0
-1.5	-2.6
-0.5	0.6
0.5	-1.1
1.5	-1.9



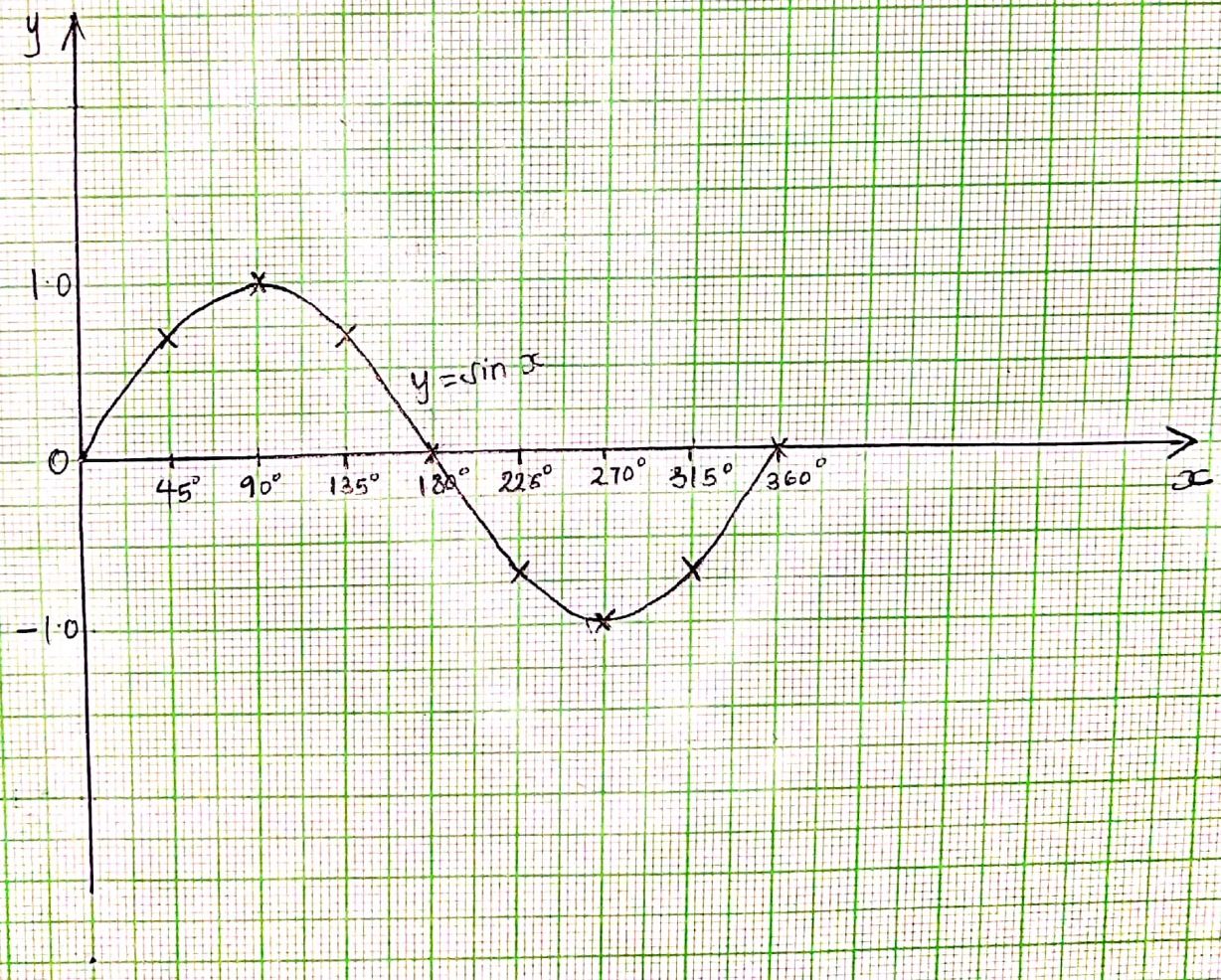
(ii) From the graph, $f(x) = 0$ at $x = -1$, $x = 0$, $x = 2$

(iii) $f(x) = g(x)$ at $x = -1$ and $x = 0.4$

Question 4 b.

$0^\circ \leq x \leq 360^\circ$

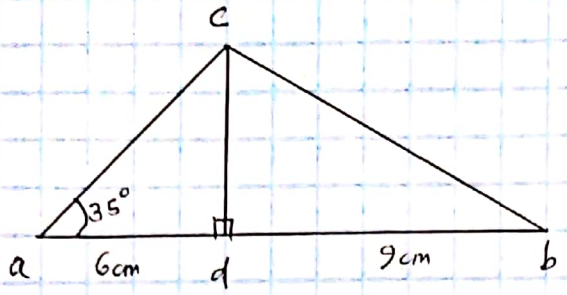
$y = \sin x$.



(ii) Range : $[-1, 1]$

An Period of the graph: 2π or 180°

Question 5



(a)

(i) |cd|

$\tan 35° = \frac{cd}{6}$; $cd = 6 \times \tan 35°$

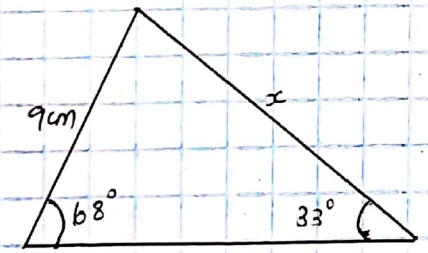
$= 4.2\text{cm}$

(ii) $|\angle cbd|$ $\tan x = \frac{4.2}{9}$

$x = \tan^{-1}(4.2/9) = 25.0$

$= 25°$

(b)



(i) Length of side x.

Applying sine rule:

$\frac{9}{\sin 33°} = \frac{x}{\sin 68°}$

$x = \frac{9 \times \sin 68°}{\sin 33°}$

$= 15.3\text{cm}$

(ii) Area of the triangle

$A = \frac{1}{2} \times 9 \times 15.3 \times \sin(180-(68+33))$; $\frac{1}{2} \times 9 \times 15.3 \times \sin 79$

$= \cancel{39.5\ \text{cm}^2}$ $67.7\ \text{cm}^2$

Question 6

(a)

(i) $y = 7x^2 + 3x$

$\frac{dy}{dx} = 2 \times 7x + 3$

$\frac{dy}{dx} = 14x + 3$

(ii) $f(x) = 6x + 3$

$f'(x) = 6$

(iii) $y = x$

$\frac{dy}{dx} = 1$

(iv) $f(x) = -7$

$f'(x) = 0 \times 7\ x^{0-1}$

$= 0$

(b) $y = (2x^2 + 2)(x + 7)$

Applying product rule:

$\frac{dy}{dx} = (2x^2 + 2)1 + (x + 7)4x$

$= 2x^2 + 2 + 4x^2 + 28x$

$\frac{dy}{dx} = 6x^2 + 28x + 2$

(c) $f(x) = \frac{2x+2}{x+1}$

Applying Quotient rule

$f'(x) \frac{(x+1)2 - (2x+2)1}{(x+1)^2}$

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

$f'(x) = 0$

(d) $y = (2x^3 - 5)^7$

Let $U = 2x^3 - 3$; $\frac{du}{dx} = 6x^2$

$\frac{dy}{du} = 7u^6$

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

$= 7(2x3 - 5)^6 \times 6x^2$

$= 42x^2(2x^3 - 5)^6$