



1 (a) Work out $2\frac{1}{7} + 1\frac{1}{4}$

$$= \frac{15}{7} + \frac{5}{4}$$

$$= \frac{60}{28} + \frac{35}{28} = \frac{95}{28}$$

$$\frac{95}{28}$$

(2)

(b) Work out $1\frac{1}{5} \div \frac{3}{4}$

Give your answer as a mixed number in its simplest form.

When dividing fractions use the rule:
Keep, Change, Flip

$$\frac{6}{5} \div \frac{3}{4}$$

$$\frac{6}{5} \times \frac{4}{3} = \frac{24}{15} = \frac{8}{5} = 1\frac{3}{5}$$

$$1\frac{3}{5}$$

(2)

(Total for Question 1 is 4 marks)

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2 In a village

the number of houses and the number of flats are in the ratio 7 : 4

the number of flats and the number of bungalows are in the ratio 8 : 5

There are 50 bungalows in the village.

How many houses are there in the village?

$$\begin{array}{rcl}
 & H : F & F : B \\
 \times 2 \downarrow & 7 : 4 & 8 : 5 \\
 & 14 : 8 & 8 : 5
 \end{array}$$

$$\begin{array}{rcl}
 & H : F : B & \\
 & 14 : 8 : 5 & \\
 & 140 : 80 : 50 & \downarrow \times 10
 \end{array}$$

140

(Total for Question 2 is 3 marks)

- 3 Renee buys 5 kg of sweets to sell.
She pays £10 for the sweets.

Renee puts all the sweets into bags.
She puts 250 g of sweets into each bag.
She sells each bag of sweets for 65p.

Renee sells all the bags of sweets.

Work out her percentage profit.

$$5000 \div 250 = 20 \text{ bags}$$

$$20 \times 65 = 1300 \text{ p} = \text{£} 13$$

$$\frac{13 - 10}{10} \times 100$$

$$= \frac{3}{10} \times \frac{100}{1}$$

$$= \frac{300}{10} = 30\%$$

$$\frac{\text{change}}{\text{original}} \times 100$$

$$\begin{array}{r} 65 \\ \times 20 \\ \hline 00 \\ 1300 \\ \hline 1300 \end{array}$$

30 %

(Total for Question 3 is 4 marks)

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3000

- 4 A cycle race across America is 3069.25 miles in length.

15

Juan knows his average speed for his previous races is 15.12 miles per hour. For the next race across America he will cycle for 8 hours per day.



- (a) Estimate how many days Juan will take to complete the race.

$$T = \frac{D}{S} = \frac{3000}{15} = 200 \text{ hours}$$

$$\begin{array}{r} 025 \\ 8 \overline{) 200} \end{array} = 25 \text{ days}$$

25

(3)

Juan trains for the race.

The average speed he can cycle at increases.

It is now 16.27 miles per hour.

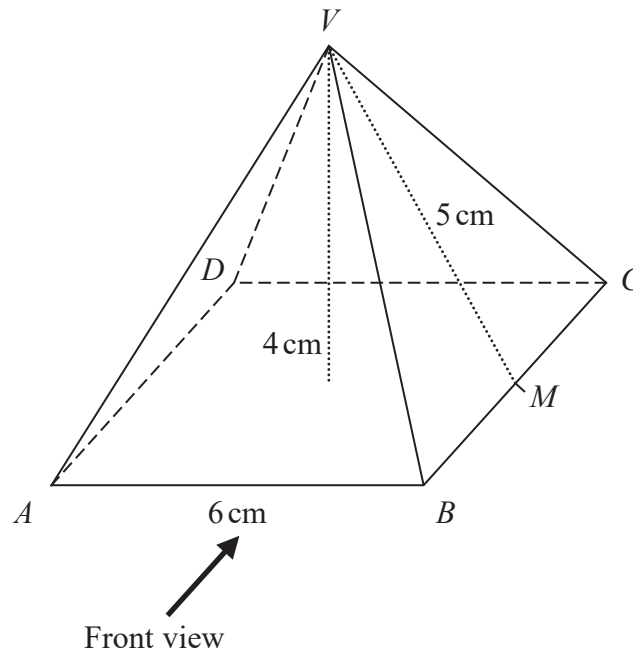
- (b) How does this affect your answer to part (a)?

It may take him less days if I used 16 instead of 15

(1)

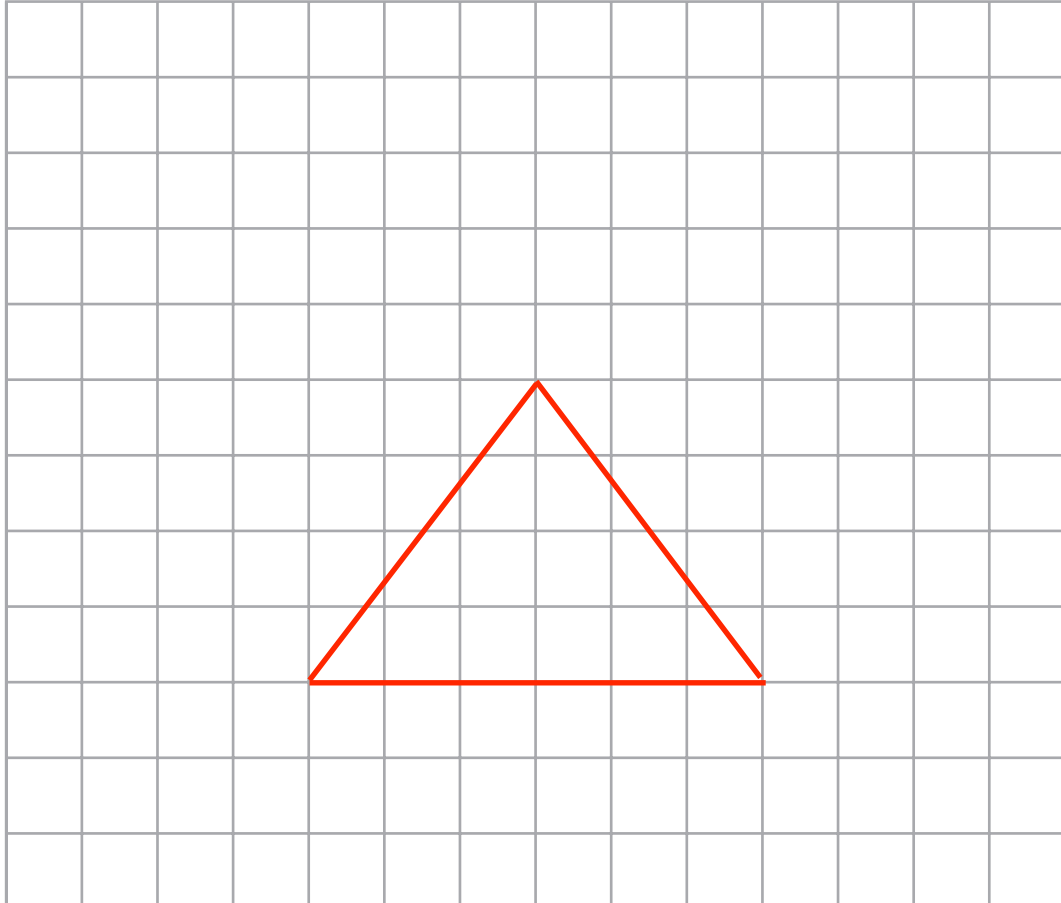
(Total for Question 4 is 4 marks)

- 5 Here is a solid square-based pyramid, $VABCD$.



The base of the pyramid is a square of side 6 cm .
 The height of the pyramid is 4 cm .
 M is the midpoint of BC and $VM = 5\text{ cm}$.

- (a) Draw an accurate front elevation of the pyramid from the direction of the arrow.



(2)

(b) Work out the total surface area of the pyramid.

$$\text{Square} = 6 \times 6 = 36 \text{ cm}^2$$

$$\begin{aligned} 1 \text{ Triangle} &= 6 \times 5 = 30 \div 2 = 15 \text{ cm}^2 \\ &\times 4 = 60 \text{ cm}^2 \end{aligned}$$

$$\begin{array}{r} 36 \\ + 60 \\ \hline 96 \end{array}$$

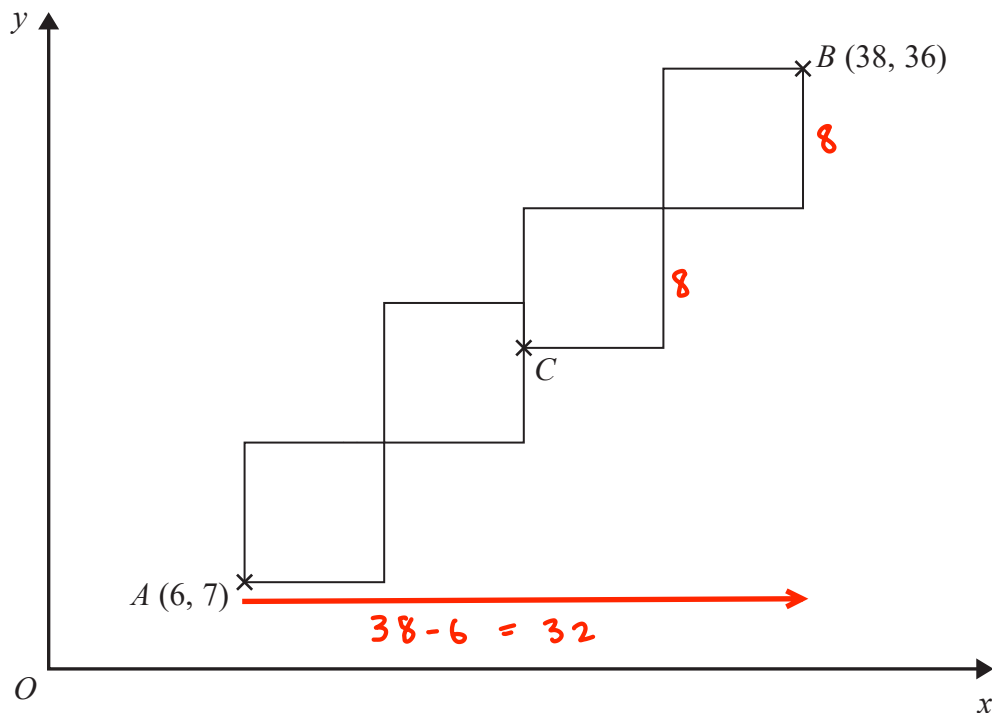
$$96 \text{ cm}^2$$

(4)

(Total for Question 5 is 6 marks)

6 A pattern is made from four identical squares.

The sides of the squares are parallel to the axes.



Point A has coordinates (6, 7)

Point B has coordinates (38, 36)

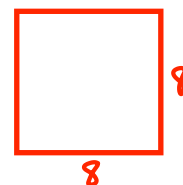
Point C is marked on the diagram.

Work out the coordinates of C.

$$x \text{ coordinate: } 32 \div 2 = 16$$

$$6 + 16 = 22$$

$$y \text{ coordinate: } 36 - 8 - 8 = 20$$



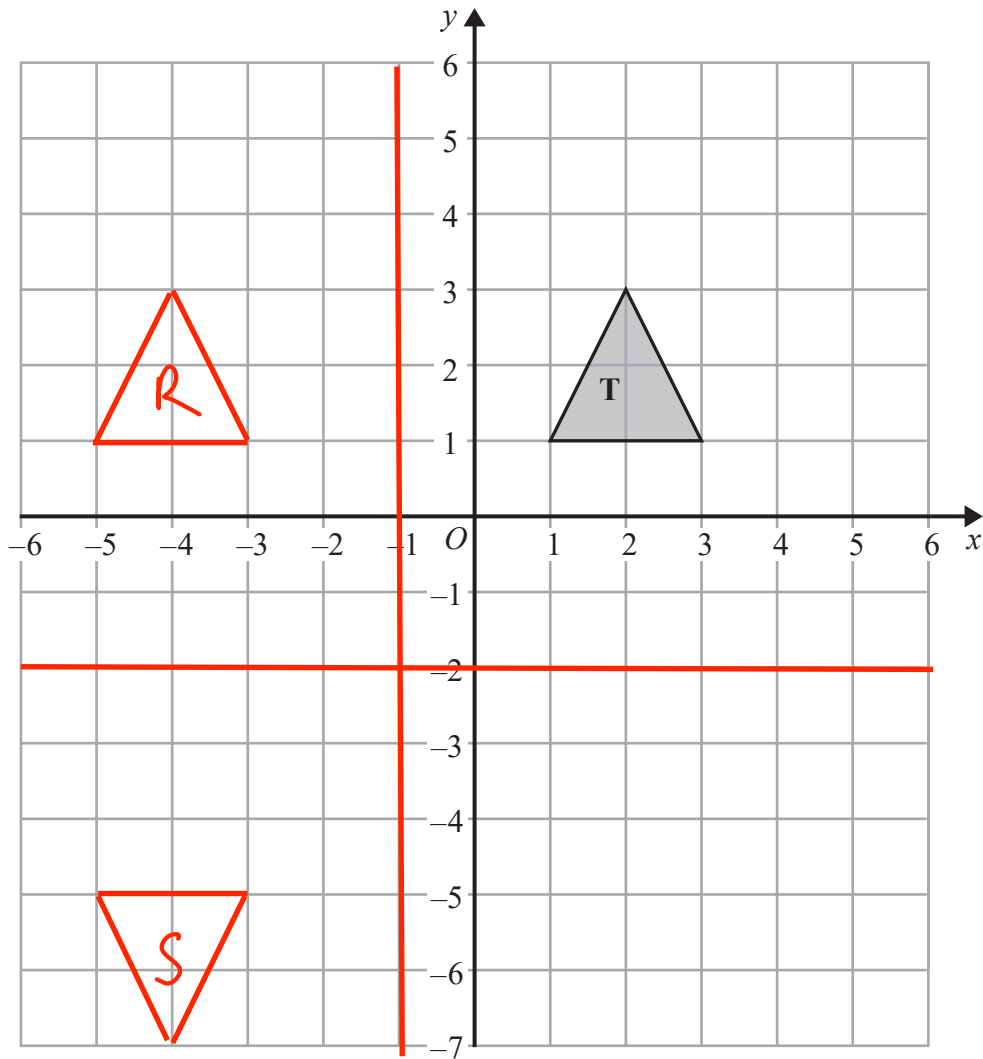
$$32 \div 4 = 8$$

(22 , 20)

(Total for Question 6 is 5 marks)



7



Shape **T** is reflected in the line $x = -1$ to give shape **R**.
Shape **R** is reflected in the line $y = -2$ to give shape **S**.

Describe the **single** transformation that will map shape **T** to shape **S**.

Rotated 180° about the point $(-1, -2)$

(Total for Question 7 is 2 marks)

- 8 The perimeter of a right-angled triangle is 72 cm.
The lengths of its sides are in the ratio 3 : 4 : 5

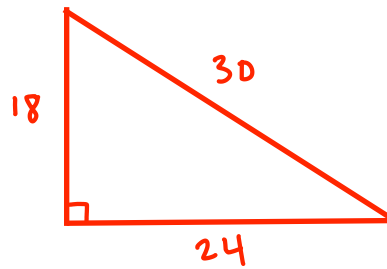
Work out the area of the triangle.

$$72 \div 12 = 6 \text{ (1 part)}$$

12
24
36
48
60
72

$$\begin{array}{l} 3 : 4 : 5 \\ 18 : 24 : 30 \end{array} \quad \begin{array}{l} \downarrow \\ \times 6 \end{array}$$

$$\begin{aligned} \text{Area} &= \frac{1}{2} \times 24 \times 18 \\ &= 12 \times 18 \\ &= 216 \end{aligned}$$



$$\begin{array}{r} \times 12 \\ 18 \\ \hline 96 \\ 120 \\ \hline 216 \end{array}$$

.....216.....cm²

(Total for Question 8 is 4 marks)

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- 9 (a) Write down the value of $36^{\frac{1}{2}}$

$$\sqrt{36} = 6$$

6
(1)

- (b) Write down the value of 23^0

Tip: Any number to the power of 0 = 1

1
(1)

- (c) Work out the value of $27^{-\frac{2}{3}}$

$$\begin{aligned} & (\sqrt[3]{27})^{-2} \\ &= 3^{-2} \\ &= \frac{1}{9} \end{aligned}$$

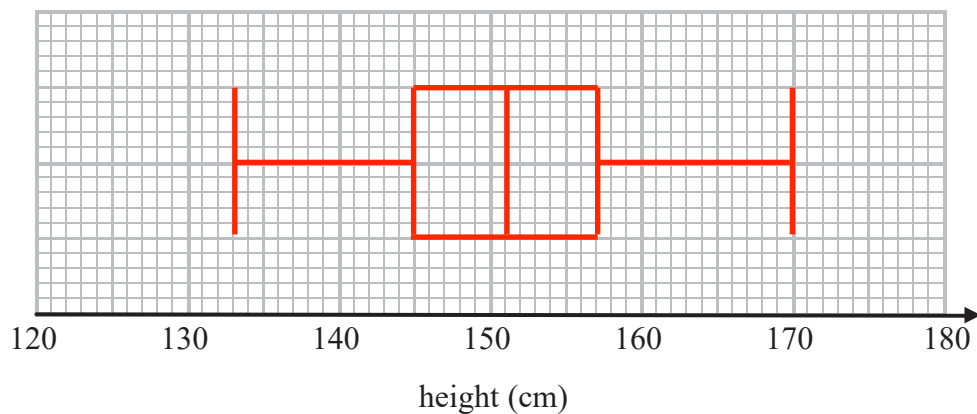
$\frac{1}{9}$
(2)

(Total for Question 9 is 4 marks)

10 The table gives some information about the heights of 80 girls.

Least height	133 cm
Greatest height	170 cm
Lower quartile	145 cm
Upper quartile	157 cm
Median	151 cm

(a) Draw a box plot to represent this information.



(3)

(b) Work out an estimate for the number of these girls with a height between 133 cm and 157 cm.

$$75\% \text{ of } 80 = 60$$

$$50\% = 40$$

$$25\% = 20$$

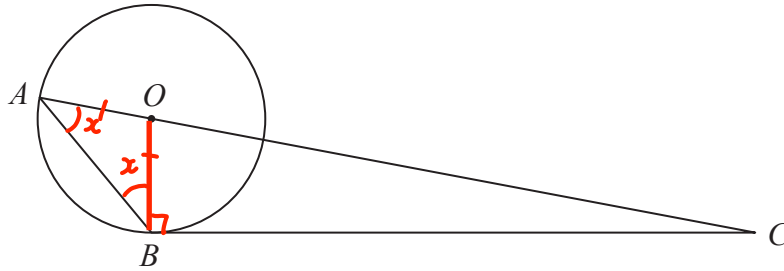
60

(2)

(Total for Question 10 is 5 marks)



11



A and B are points on a circle, centre O .

BC is a tangent to the circle.

AOC is a straight line.

Angle $ABO = x^\circ$.

Find the size of angle ACB , in terms of x .

Give your answer in its simplest form.

Give reasons for each stage of your working.

$$\angle OBC = 90^\circ$$

because the radius meets the tangent at 90°

$$\angle OAB = x \quad \text{because base angles in an Isosceles triangle are the same}$$

$$\angle ACB = 180 - x - x - 90 \quad \text{because angles in triangle add to } 180$$

$$= 90 - 2x$$

(Total for Question 11 is 5 marks)

12 Prove that the square of an odd number is always 1 more than a multiple of 4

Tip: Any odd number can be represented as ' $2n + 1$ '

$$\begin{aligned}(2n+1)^2 &= (2n+1)(2n+1) = 4n^2 + 2n + 2n + 1 \\ &= 4n^2 + 4n + 1 \\ &= 4(n^2 + n) + 1\end{aligned}$$

$4(n^2 + n) + 1$ is 1 more than a multiple of 4 for all values of n

(Total for Question 12 is 4 marks)

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- 13 $\sqrt{5}(\sqrt{8} + \sqrt{18})$ can be written in the form $a\sqrt{10}$ where a is an integer.

Find the value of a .

$$\begin{aligned}
 &= \sqrt{40} + \sqrt{90} \\
 &= \sqrt{4} \times \sqrt{10} + \sqrt{9} \times \sqrt{10} \\
 &= 2\sqrt{10} + 3\sqrt{10} \\
 &= 5\sqrt{10}
 \end{aligned}$$

$$\begin{array}{r}
 18 \\
 \times 5 \\
 \hline
 90 \\
 4
 \end{array}$$

$$a = 5$$

(Total for Question 13 is 3 marks)

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14 y is inversely proportional to d^2

When $d = 10$, $y = 4$

d is directly proportional to x^2

When $x = 2$, $d = 24$

Find a formula for y in terms of x .

Give your answer in its simplest form.

$$y \propto \frac{1}{d^2}$$

$$y = \frac{k}{d^2}$$

$$4 = \frac{k}{(10)^2}$$

$$4 = \frac{k}{100}$$

$$\begin{array}{l} \times 100 \\ 400 = k \end{array}$$

$$y = \frac{400}{d^2}$$

$$\begin{array}{l} d \propto x^2 \\ d = kx^2 \\ 24 = k(2)^2 \\ 24 = k \times 4 \\ \div 4 \quad \div 4 \\ 6 = k \end{array}$$

$$d = 6x^2$$

$$y = \frac{400}{(6x^2)^2} = \frac{400}{36x^4} = \frac{100}{9x^4}$$

$$\frac{100}{9x^4}$$

(Total for Question 14 is 5 marks)

15 (a) Factorise $a^2 - b^2$ Tip: As a^2 and b^2 are both square numbers, this is the difference of two squares.

$$(a+b)(a-b)$$

(1)

(b) Hence, or otherwise, simplify fully $(x^2 + 4)^2 - (x^2 - 2)^2$

$$a = x^2 + 4$$

$$b = x^2 - 2$$

$$(x^2 + 4 + x^2 - 2)(x^2 + 4 - (x^2 - 2))$$

$$= (2x^2 + 2)(6)$$

$$= 12x^2 + 12$$

$$12x^2 + 12$$

(3)

(Total for Question 15 is 4 marks)

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- 16 There are only red counters, blue counters and purple counters in a bag.
The ratio of the number of red counters to the number of blue counters is 3 : 17
Sam takes at random a counter from the bag.
The probability that the counter is purple is 0.2
Work out the probability that Sam takes a red counter.

$$P(\text{Red or Blue}) = 0.8 = 80\%$$

$$3 + 17 = 20$$

$$80 \div 20 = 4\% \text{ (1 part)}$$

$$4 \times 3 = 12$$

$$12\%$$

(Total for Question 16 is 3 marks)

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17 Simplify fully $\frac{3x^2 - 8x - 3}{2x^2 - 6x}$

$$= \frac{(3x+1)(\cancel{x-3})}{2x(\cancel{x-3})}$$

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

$$\begin{array}{r} + -8 - 9 \\ 3x^2 - 8x - 3 \end{array} \quad \begin{array}{r} x - 9 \\ -9, 1 \end{array}$$

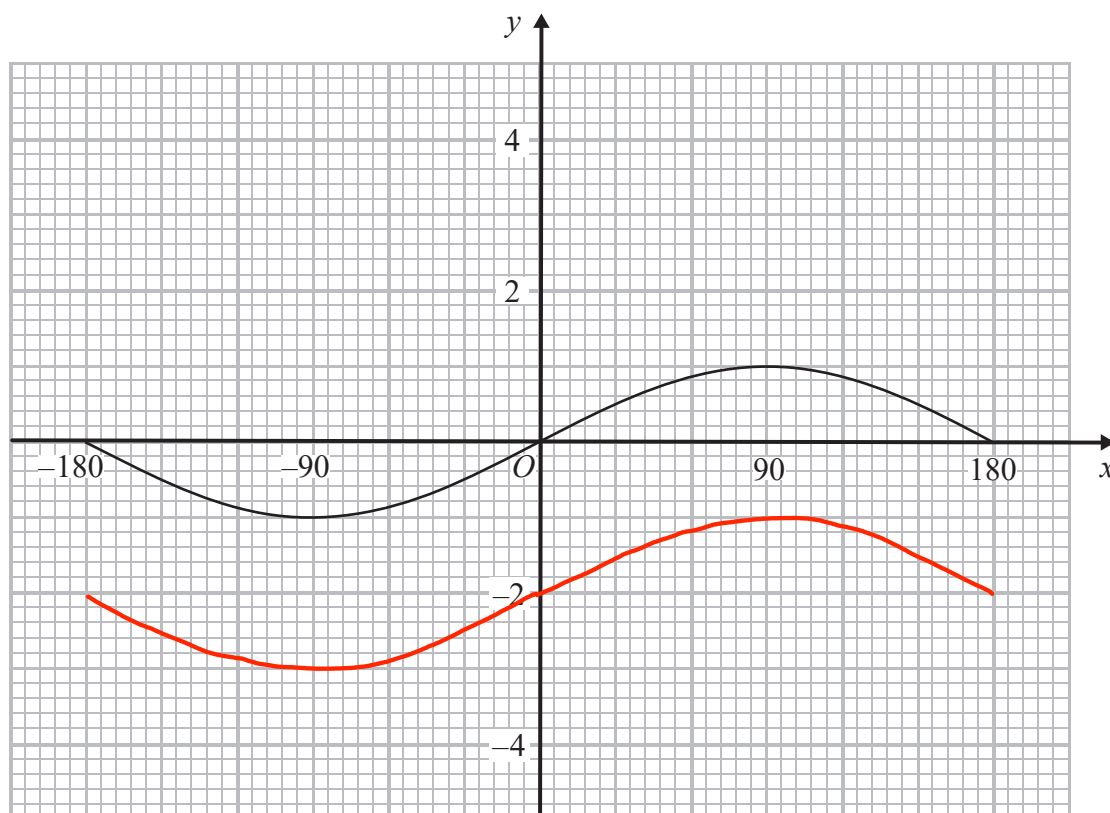
$$\begin{array}{r} 3x^2 - 9x \\ 3x(x-3) \end{array} \quad \begin{array}{r} + x - 3 \\ 1(x-3) \end{array}$$

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

$$\frac{3x+1}{2x}$$

(Total for Question 17 is 3 marks)

18 Here is the graph of $y = \sin x^\circ$ for $-180 \leq x \leq 180$



On the grid, sketch the graph of $y = \sin x^\circ - 2$ for $-180 \leq x \leq 180$

(Total for Question 18 is 2 marks)

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- 19 The point P has coordinates $(3, 4)$
The point Q has coordinates (a, b)

A line perpendicular to PQ is given by the equation $3x + 2y = 7$

Find an expression for b in terms of a .

$$\begin{array}{rcl}
 3x + 2y & = & 7 \\
 -3x & & -3x \\
 \hline
 2y & = & -3x + 7 \\
 \div 2 & & \div 2 \\
 y & = & -\frac{3}{2}x + \frac{7}{2}
 \end{array}$$

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

$$\text{So gradient of } PQ = \frac{2}{3}$$

$$\begin{array}{rcl}
 \frac{b-4}{a-3} & = & \frac{2}{3} \\
 3b-12 & = & 2a-6 \\
 +12 & & +12 \\
 3b & = & 2a+6 \\
 \div 3 & & \div 3 \\
 b & = & \frac{2}{3}a + 2
 \end{array}$$

Tip: When you have two fractions equal to each other, you can cross multiply to eliminate the denominator!

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

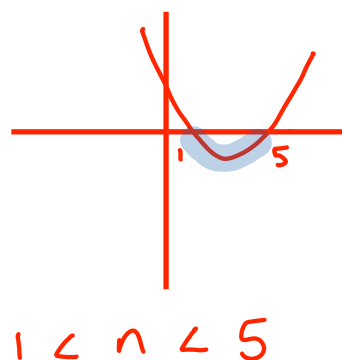
(Total for Question 19 is 5 marks)

20 n is an integer such that $3n + 2 \leq 14$ and $\frac{6n}{n^2 + 5} > 1$

Find all the possible values of n .

$$\begin{array}{rcl} 3n + 2 & \leq & 14 \\ -2 & & -2 \\ 3n & \leq & 12 \\ n & \leq & 4 \end{array}$$

$$\begin{array}{rcl} \frac{6n}{n^2 + 5} & > & 1 \\ \times (n^2 + 5) & & \times (n^2 + 5) \\ 6n & > & n^2 + 5 \\ -6n & & -6n \\ 0 & > & n^2 - 6n + 5 \\ 0 & > & (n - 5)(n - 1) \\ n & = & 5 \\ n & = & 1 \end{array}$$



To satisfy both:

$$1 < n \leq 4$$

2, 3, 4

(Total for Question 20 is 5 marks)

TOTAL FOR PAPER IS 80 MARKS