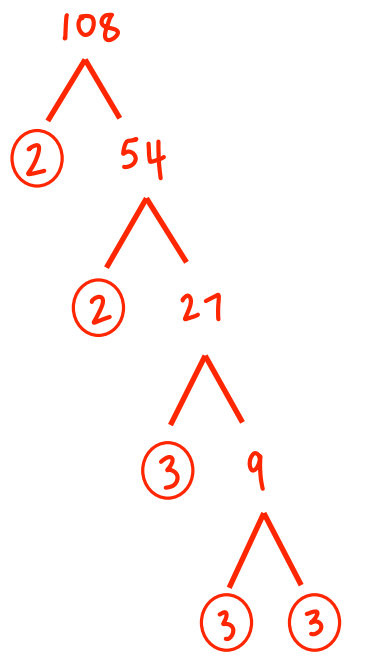
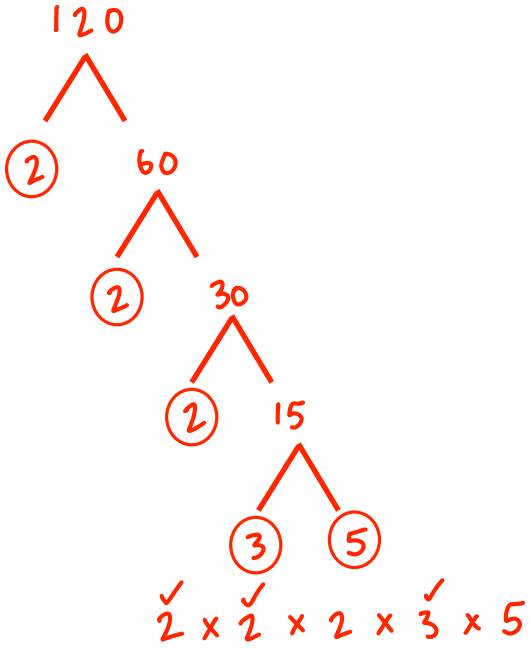
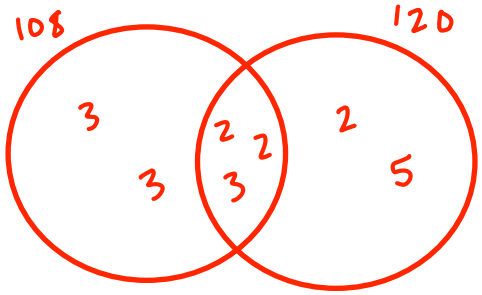
1 Find the Lowest Common Multiple (LCM) of 108 and 120



$\checkmark 2 \times \checkmark 2 \times \checkmark 3 \times 3 \times 3$



$\checkmark 2 \times \checkmark 2 \times 2 \times \checkmark 3 \times 5$



$108 \times 2 = 216$

$216 \times 5 = 1080$

1080

(Total for Question 1 is 3 marks)

$$\begin{array}{r} 216 \\ \times \quad 5 \\ \hline 1080 \end{array}$$

3

2 There are 60 people in a choir.
Half of the people in the choir are women.

The number of women in the choir is 3 times the number of men in the choir.
The rest of the people in the choir are children.

the number of children in the choir : the number of men in the choir = n : 1

Work out the value of n.
You must show how you get your answer.

W = 30

M = 30 ÷ 3 = 10

C = 60 - 30 - 10 = 20

C : M

20 : 10 ÷10

2 : 1 ÷10

n = 2

(Total for Question 2 is 4 marks)

3 Work out $1\frac{3}{4} \times 1\frac{1}{3}$

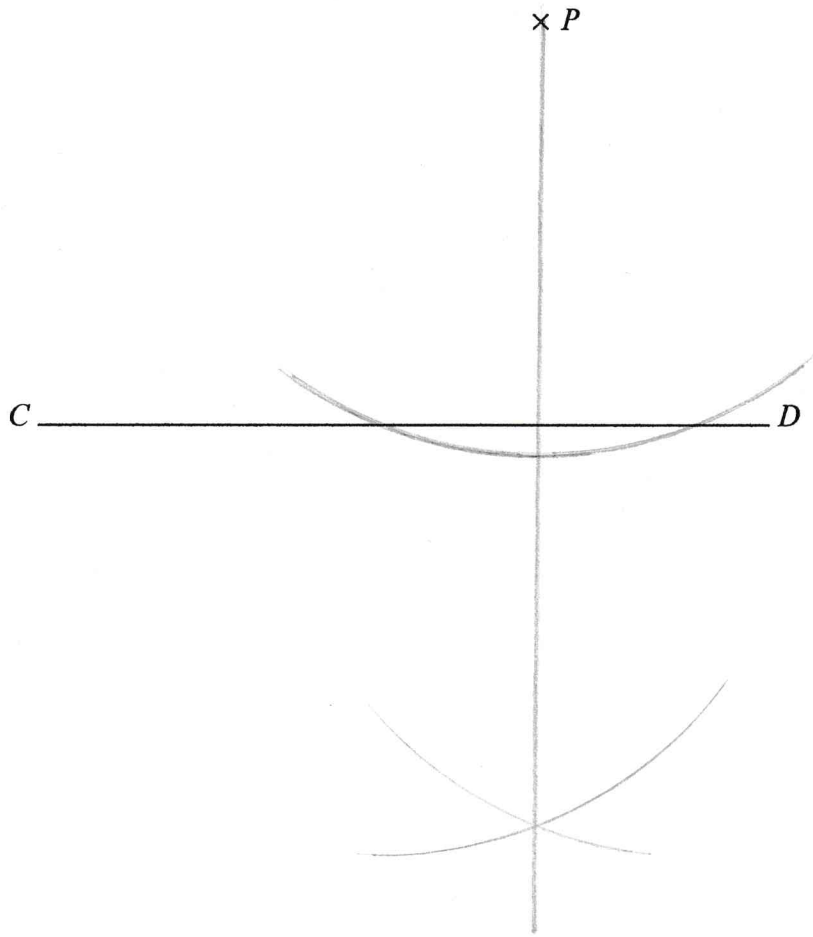
Give your answer as a mixed number.

$\frac{7}{4} \times \frac{4}{3} = \frac{28}{12} = \frac{7}{3}$

$2\frac{1}{3}$

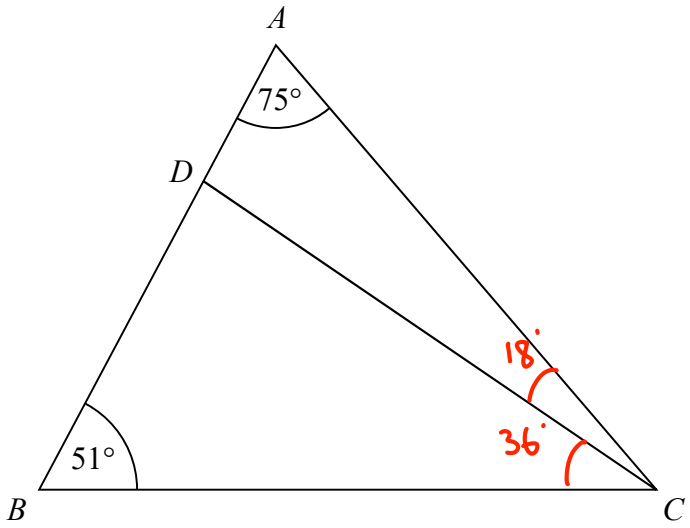
(Total for Question 3 is 3 marks)

4 Use a ruler and compasses to construct the line from the point P perpendicular to the line CD.
You must show **all** construction lines.



(Total for Question 4 is 2 marks)

5 The diagram shows triangle *ABC*.



ADB is a straight line.

the size of angle *DCB* : the size of angle *ACD* = 2 : 1

Work out the size of angle *BDC*.

DCB : ACD
2 : 1
36 : 18

51 + 75 = 126

180 − 126 = 54

∠ACB = 54

$3\overline{)54}$ = 18

51 + 36 = 87

180 − 87 = 93

93 °

(Total for Question 5 is 4 marks)

6 4 red bricks have a mean weight of 5 kg.
5 blue bricks have a mean weight of 9 kg.
1 green brick has a weight of 6 kg.

Donna says,

"The mean weight of the 10 bricks is less than 7 kg."

Is Donna correct?
You must show how you get your answer.

$4 \times 5 = 20\text{kg}$ (Total 4 bricks)

$5 \times 9 = 45\text{kg}$ (Total 5 bricks)

$1 \times 6 = 6\text{kg}$ (Total 1 brick)

$20 + 45 + 6 = 71$

$71 \div 10 = 7.1\text{ kg}$

Donna is incorrect!

(Total for Question 6 is 3 marks)

7 (a) Simplify $(p^2)^5$

p^{10}

(1)

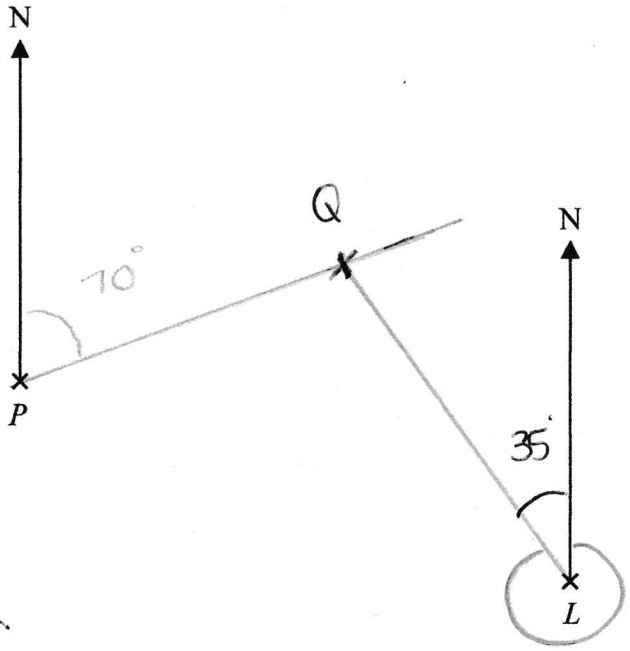
(b) Simplify $12x^7y^3 \div 6x^3y$

$2x^4y^2$

(2)

(Total for Question 7 is 3 marks)

8 The accurate scale drawing shows the positions of port P and a lighthouse L.



÷4

Scale: 1 cm represents 4 km.

Aleena sails her boat from port P on a bearing of 070°

She sails for $1\frac{1}{2}$ hours at an average speed of 12 km/h to a port Q.

Find

(i) the distance, in km, of port Q from lighthouse L,

(ii) the bearing of port Q from lighthouse L.

i) $D = S \times T$

$= 12 \times 1.5 = 18\text{KM}$

$18 \div 4 = 4.5\text{cm}$ $QL = 5.2\text{cm}$

$\times 4 = 20.8\text{KM}$

ii) $360 - 35 = 325$

(20 to 23)

distance QL = 20.8 km

bearing of Q from L = 325 °

(Total for Question 8 is 5 marks) (317 to 330)

9 A car travels for 18 minutes at an average speed of 72 km/h.

(a) How far will the car travel in these 18 minutes?

÷10 (72 km = 60 mins) ÷10
(7.2 km = 6 mins)
x3 (21.6 km = 18 mins) x3

72
x 3
216

21.6 km

(2)

David says,

"72 kilometres per hour is faster than 20 metres per second."

(b) Is David correct?
You must show how you get your answer.

72 km = 60 mins
÷3600 (72000 m = 3600 seconds) ÷3600
(20 m = 1 second)

$\frac{72000}{3600} = \frac{720}{36} = 20$

NO, it is the same

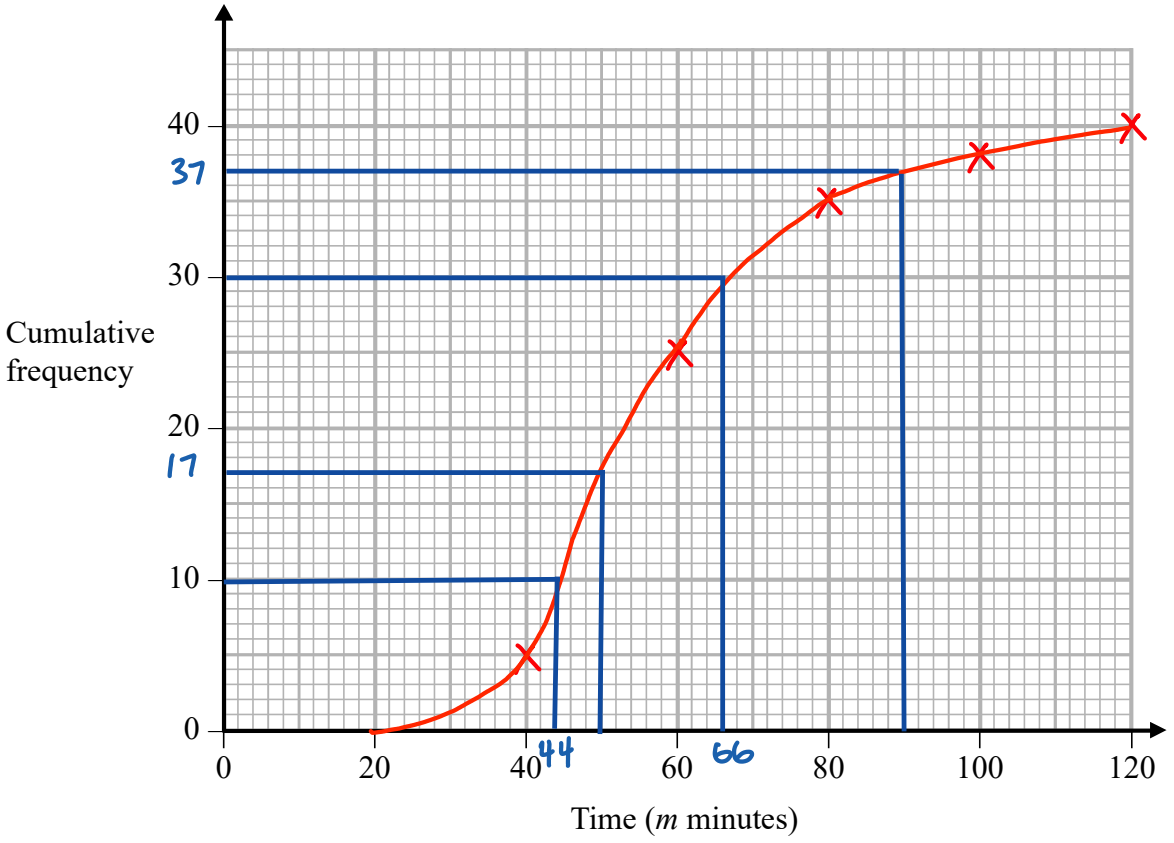
(2)

(Total for Question 9 is 4 marks)

10 The cumulative frequency table shows information about the times, in minutes, taken by 40 people to complete a puzzle.

Time (m minutes)	Cumulative frequency
$20 < m \leqslant 40$	5
$20 < m \leqslant 60$	25
$20 < m \leqslant 80$	35
$20 < m \leqslant 100$	38
$20 < m \leqslant 120$	40

(a) On the grid below, draw a cumulative frequency graph for this information.



(2)

(b) Use your graph to find an estimate for the interquartile range.

66 - 44 = 22

22 (21 to 28) minutes (2)

One of the 40 people is chosen at random.

(c) Use your graph to find an estimate for the probability that this person took between 50 minutes and 90 minutes to complete the puzzle.

37 - 17 = 20 (19 to 24)

$\frac{20}{40}$ (2)

(Total for Question 10 is 6 marks)

11 There are p counters in a bag.
12 of the counters are yellow.

Shafiq takes at random 30 counters from the bag.
5 of these 30 counters are yellow.

Work out an estimate for the value of p.

$\frac{12}{p} = \frac{5}{30}$ (×2.4)

$30 \times 2.4 = 72$

$5 \overline{)12.0}$ → 2.4

30 × 24 = 120 + 600 = 720

72

(Total for Question 11 is 2 marks)

12 $T = \frac{q}{2} + 5$

Here is Spencer's method to make q the subject of the formula.

$2 \times T = q + 5$

$q = 2T - 5$

What mistake did Spencer make in the first line of his method?

He needed to multiply everything by 2, he did not multiply the 5 by 2.

(Total for Question 12 is 1 mark)

(Total for Question 11 is 2 marks)

13 (a) Write $\frac{5}{x+1} + \frac{2}{3x}$ as a single fraction in its simplest form.

Tip: To add fractions you need to have the same denominator

$$\frac{15x}{3x(x+1)} + \frac{2(x+1)}{3x(x+1)} = \frac{15x + 2x + 2}{3x(x+1)}$$

$$\frac{17x + 2}{3x(x+1)}$$

(2)

(b) Factorise $(x + y)^2 + 3(x + y)$

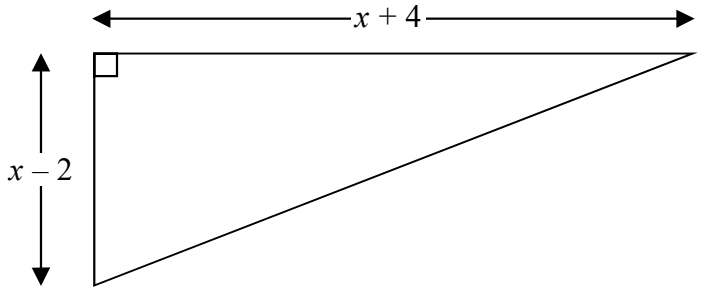
Tip: (x + y) is the HCF

$$(x+y)(x+y+3)$$

(1)

(Total for Question 13 is 3 marks)

14 The diagram shows a right-angled triangle.



All the measurements are in centimetres.

The area of the triangle is 27.5 cm^2

$\frac{1}{2} \times b \times h$

Work out the length of the shortest side of the triangle.
You must show all your working.

$\frac{1}{2}(x+4)(x-2) = 27.5$

$\times 2 \quad \times 2$

$(x+4)(x-2) = 55$

$x^2 - 2x + 4x - 8 = 55$

$x^2 + 2x - 8 = 55$

$-55 \quad -55$

$x^2 + 2x - 63 = 0$

$(x+9)(x-7) = 0$

$x = -9$ or $x = 7$

$7 - 2 = 5$

5 cm

(Total for Question 14 is 4 marks)

15 Express $0.4\dot{1}\dot{8}$ as a fraction.
You must show all your working.

Tip: If there is one recurring digit multiply by 10, if there are two recurring digits multiply by 100, if there are three recurring digits multiply by 1000.

$100x = 41.818181\ldots$
$-\quad x = 0.418181\ldots$

$99x = 41.4$
$\div 99 \quad \div 99$
$x = \frac{41.4}{99} = \frac{414}{990}$

Tip: We are not asked for the fraction in its simplest form, so you do not have to simplify any further

$\frac{414}{990}$

(Total for Question 15 is 3 marks)

16 (a) Rationalise the denominator of $\frac{22}{\sqrt{11}}$

$\frac{22}{\sqrt{11}} \times \frac{\sqrt{11}}{\sqrt{11}} = \frac{22\sqrt{11}}{11} = 2\sqrt{11}$

Give your answer in its simplest form.

$2\sqrt{11}$

(2)

(b) Show that $\frac{\sqrt{3}}{2\sqrt{3}-1}$ can be written in the form $\frac{a+\sqrt{3}}{b}$ where a and b are integers.

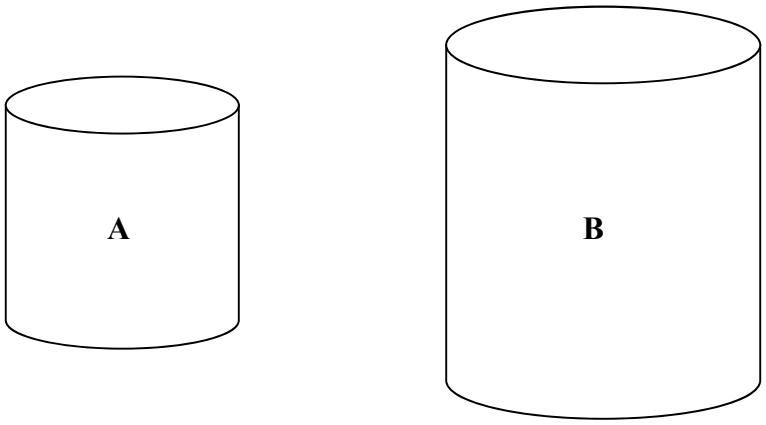
$\frac{\sqrt{3}}{2\sqrt{3}-1} \times \frac{2\sqrt{3}+1}{2\sqrt{3}+1} = \frac{2(3)+\sqrt{3}}{4(3)+2\sqrt{3}-2\sqrt{3}-1}$

$= \frac{6+\sqrt{3}}{12-1} = \frac{6+\sqrt{3}}{11}$

(3)

(Total for Question 16 is 5 marks)

17 **A** and **B** are two similar cylindrical containers.



the surface area of container **A** : the surface area of container **B** = 4 : 9

Tyler fills container **A** with water.
She then pours all the water into container **B**.
Tyler repeats this and stops when container **B** is full of water.

(volume)

Work out the number of times that Tyler fills container **A** with water.
You must show all your working.

A : B
4 : 9 ✓ (area SF) ✓
2 : 3 (length SF)
8 : 27 (volume SF)

$27 \div 8 = 3.375$

$$8 \overline{)27.3^{6}0^{4}0} \quad 03.375$$

4

(Total for Question 17 is 4 marks)

18 The function f is given by

$$f(x) = 2x^3 - 4$$

(a) Show that $f^{-1}(50) = 3$

$2x^3 - 4 = 50$
$+4 \quad +4$
$2x^3 = 54$
$\div 2 \quad \div 2$
$x^3 = 27$
$\sqrt[3]{} \quad \sqrt[3]{}$
$x = 3$

(2)

The functions g and h are given by

$$g(x) = x + 2 \text{ and } h(x) = x^2$$

(b) Find the values of x for which

$$hg(x) = 3x^2 + x - 1$$

$hg(x) = (x+2)^2 = (x+2)(x+2) = x^2 + 2x + 2x + 4$
$= x^2 + 4x + 4$

$x^2 + 4x + 4 = 3x^2 + x - 1$
$-x^2 \quad -x^2$
$4x + 4 = 2x^2 + x - 1$
$-4x \quad -4x$
$4 = 2x^2 - 3x - 1$
$-4 \quad -4$
$0 = 2x^2 - 3x - 5$ (+-3, x10) -5 and 2
$0 = 2x^2 + 2x - 5x - 5$
$0 = 2x(x+1) - 5(x+1)$
$0 = (2x-5)(x+1)$
$x = \frac{5}{2}$ or -1

$x = \frac{5}{2}$, $x = -1$

(4)

(Total for Question 18 is 6 marks)

19 Given that $9^{-\frac{1}{2}} = 27^{\frac{1}{4}} \div 3^{x+1}$
find the exact value of x.

Tip: To work with indices we need to have the same base. 9, 27 and 3 can all be written as a power of 3.

$(3^2)^{-\frac{1}{2}} = (3^3)^{\frac{1}{4}} \div 3^{x+1}$

$3^{-1} = 3^{3/4} \div 3^{x+1}$

$-1 = 0.75 - (x+1)$

$-1 = 0.75 - x - 1$

$-1 = -0.25 - x$

$+x \quad\quad +x$

$x - 1 = -0.25$

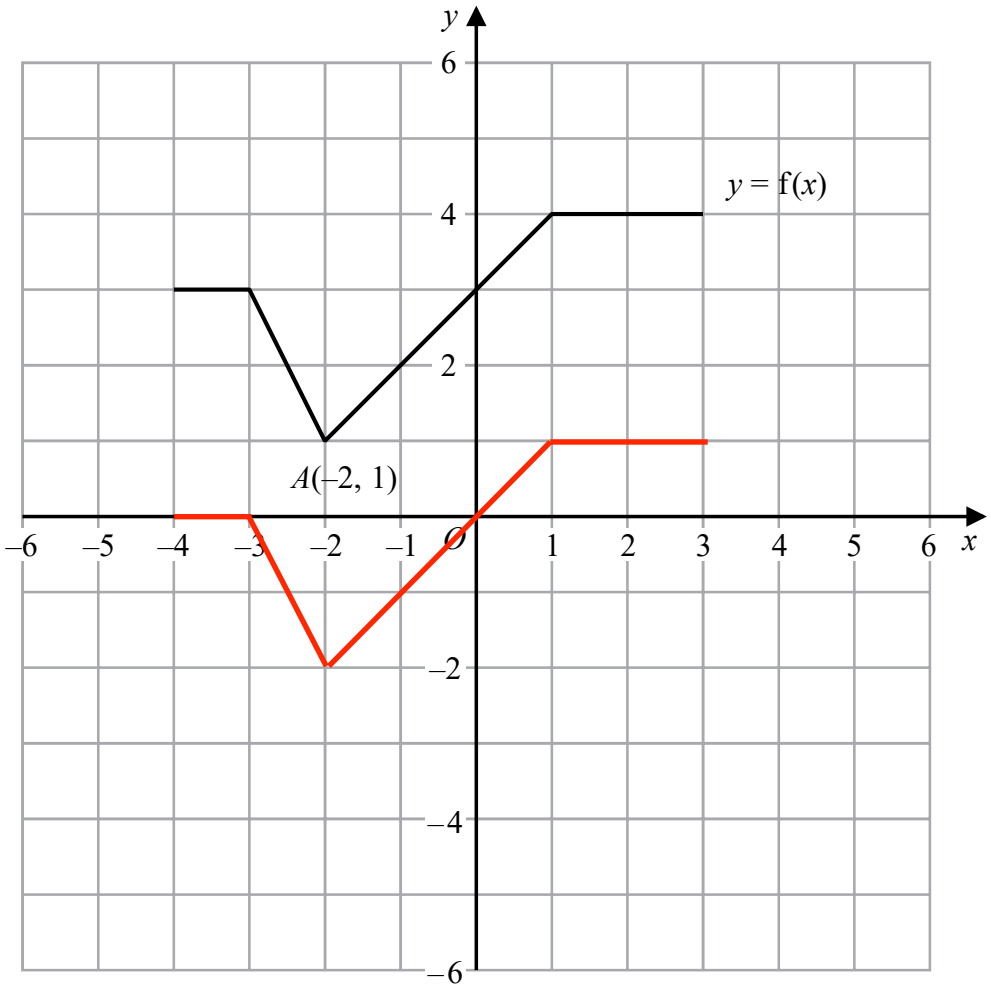
$+1 \quad\quad +1$

$x = 0.75$

$x =$ 0.75

(Total for Question 19 is 3 marks)

20 The graph of $y = f(x)$ is shown on the grid.



(a) On the grid, draw the graph with equation $y = f(x + 1) - 3$

(2)

Point $A(-2, 1)$ lies on the graph of $y = f(x)$.

When the graph of $y = f(x)$ is transformed to the graph with equation $y = f(-x)$, point A is mapped to point B.

(b) Write down the coordinates of point B.

(2 , 1)

(1)

(Total for Question 20 is 3 marks)

21 Sketch the graph of

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

showing the coordinates of the turning point and the exact coordinates of any intercepts with the coordinate axes.

Tip: To find the turning point you need to complete the square

TP: $2[x^2 - 4x - 2.5]$

$2[(x-2)^2 - 6.5]$

$2(x-2)^2 - 13$

TP = $(2, -13)$

To solve:

$2(x-2)^2 - 13 = 0$

$+13 \quad +13$

$2(x-2)^2 = 13$

$\div 2 \quad \div 2$

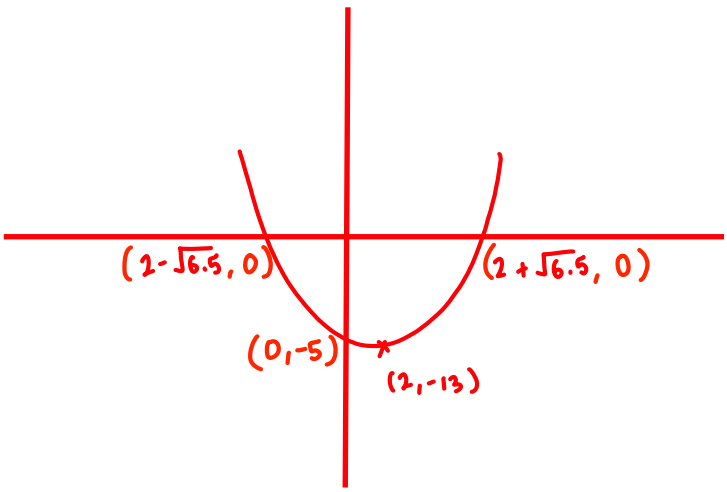
$(x-2)^2 = 6.5$

$\sqrt{} \quad \sqrt{}$

$x - 2 = \pm\sqrt{6.5}$

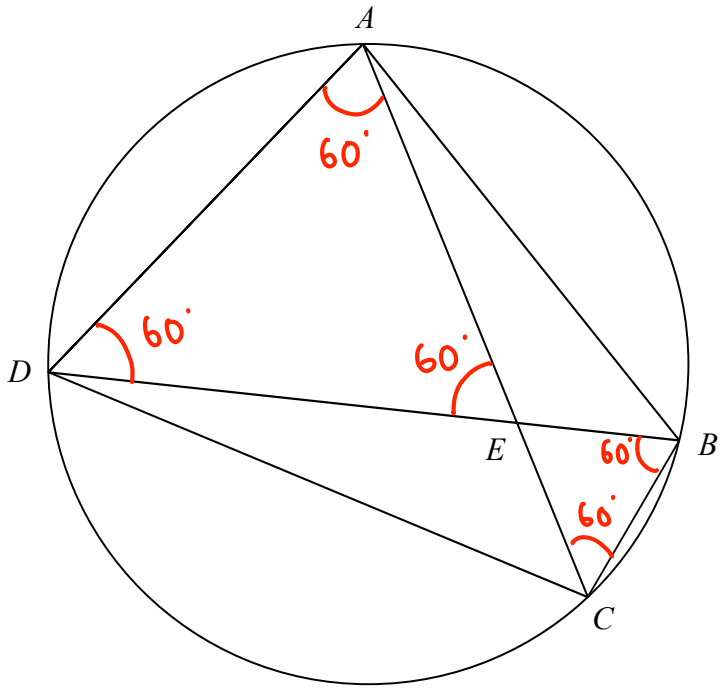
$+2 \quad +2$

$x = 2 \pm \sqrt{6.5}$



(Total for Question 21 is 5 marks)

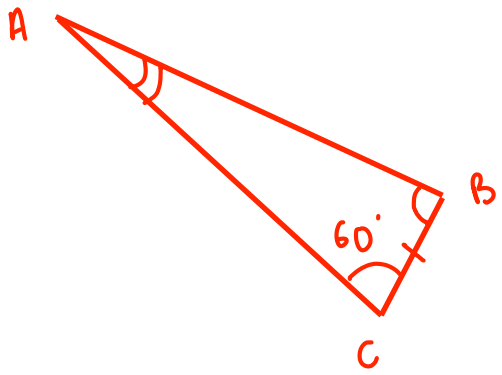
22 *A*, *B*, *C* and *D* are four points on a circle.

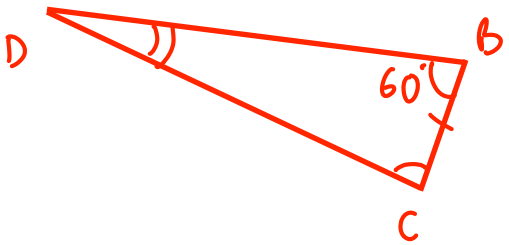


AEC and *DEB* are straight lines.

Triangle *AED* is an equilateral triangle.

Prove that triangle *ABC* is congruent to triangle *DCB*.





BC = BC

∠BDC = ∠BAC as angles in the same segment are equal

<ADB = <ACB = 60° as angles in the same segment are equal

<DAC = < DBC = 60° as angles in the same segment are equal

<ABC = <DCB as both equal 180 - 60 - BAC or BDC (which are the same)

∴ congruent as ASA

(Total for Question 22 is 4 marks)

TOTAL FOR PAPER IS 80 MARKS