1. Given that $a = -6$, $b = 3$ and $c = 4$, find the value of each of the following expressions.

(a) $\dfrac{a^2}{4} - a$ [2]

$$= \frac{(-6)^2 - (-6)}{4}$$

$$= \frac{36 + 6}{4}$$

$$= 9 + 6$$

$$= 15$$

(b) $(2b)^3$ [2]

$$= (2 \times 3)^3$$

$$= 6^3$$

$$= 216$$

$6 \times 6 = 36$ $\begin{array}{r} 36 \\ \times\ 6 \\ \hline 216 \end{array}$

(c) $\dfrac{8 \cdot 5a + b}{c}$ [3]

$$= \frac{8 \cdot 5(-6) + 3}{4}$$

$$= \frac{-51 + 3}{4}$$

$$= \frac{-48}{4}$$

$$= -12$$

$6 \times 8 = 48$

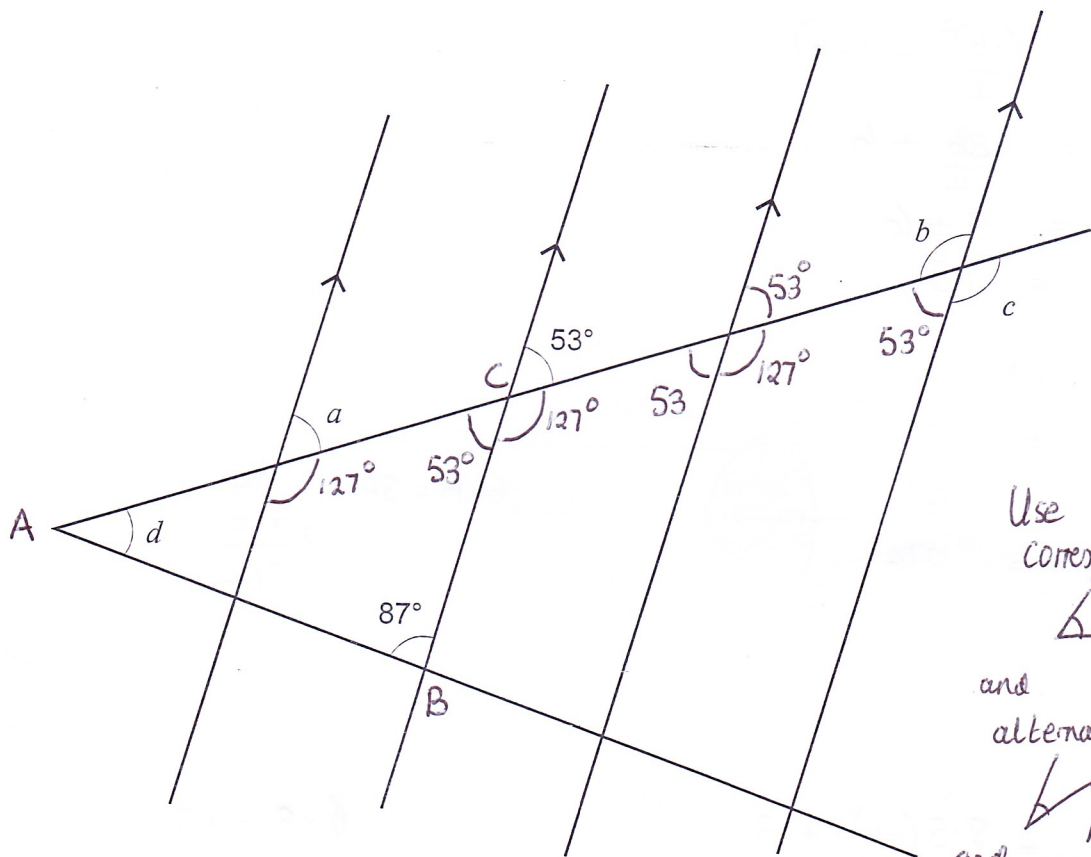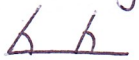$6 \times 0 \cdot 5 = 3$

$6 \times 8 \cdot 5 = 48 + 3$

2.

Diagram not drawn to scale

Find the size of each of the angles a, b, c and d.

[4]

$d = 180 - 87 - 53$ using the $\triangle ABC$

$d = 40°$

$a = \underline{\quad 53 \quad}$ °

$b = \underline{\quad 127 \quad}$ °

$c = \underline{\quad 127 \quad}$ °

$d = \underline{\quad 40° \quad}$ °

    (4370-05)

3. (a) Find the highest common factor of 32 and 40. [1]

8

32 factors 1, 32, 2, 16, 4, 8

40 factors 1, 40, 2, 20, 4, 10, 5, 8

(b) Find the lowest common multiple of 6 and 8. [1]
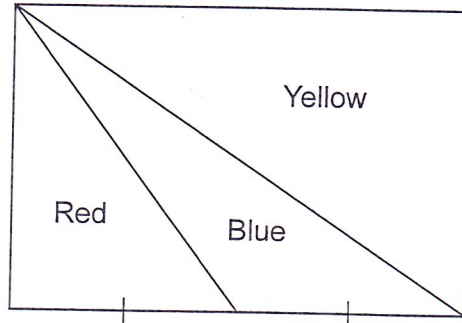
8 times table

8, 16, 24, 32, . . .

24

4 × 6

(c) Express $\frac{0.2 \times 0.5}{100}$ as a fraction in its simplest form. [2]

×10   ×10

×10×10

$= \frac{2 \times 5}{10000}$

$= \frac{10}{10\,000}$ ÷10   ÷10

$= \frac{1}{1000}$

4. Mari is painting a rectangular logo.
   Her design is shown below.

Mari needs 380 ml of red paint for her logo.
Find the quantities of blue paint and yellow paint she needs for her logo.   [2]

Red = ¼ paint = 4⟌380 = 95mL

Blue = ¼ paint = 95mL

Yellow = ½ paint = 190mL

Blue paint   95   ml

Yellow paint   190   ml

5. Rhodri's toolbox contains some nails.
   He measures the lengths of all these nails in mm.

   (a)

Length of nail, L (mm)	$10 < L \leqslant 15$	$15 < L \leqslant 20$	$20 < L \leqslant 25$	$25 < L \leqslant 30$	$30 < L \leqslant 35$
Frequency	12	18	27	39	24

TOTAL nails = 12 + 18 + 27 + 39 + 24 = 120

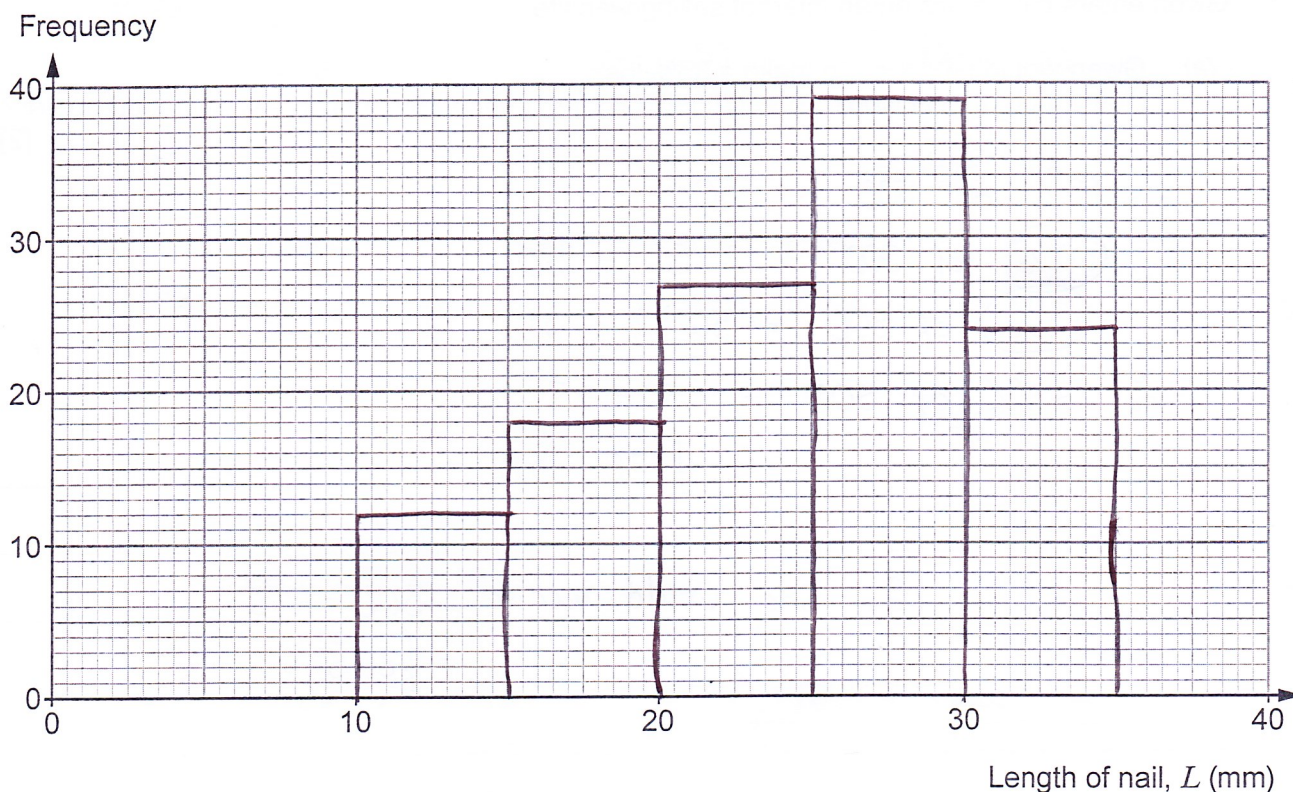   (i) In which group would Rhodri find the median length of nail?   [2]

∴ median is 60'th length when is ascending order

12 + 18 + 27 = 57   ∴ 60'th (median) lies in $25 < L \leqslant 30$

(ii)   On the graph paper below, draw a grouped frequency diagram to show all the data given in the table.   [2]

Frequency

Length of nail, L (mm)

(b)   The heads of the nails are all circular.
The head of each nail has a diameter of 2·4 mm.

Ten of these nails are knocked into a piece of wood, so that just the circular metal heads are seen.
Using an estimate of $\pi = 3$, calculate the total area of metal that can be seen on the surface of the wood.

You must show your working and give the units of your answer.   [5]

Area of Metal $= 10 \times \pi r^2$
                $= 10 \times 3 \times 1·2 \times 1·2$
                $= 30 \times 1·44$
                $= 3 \times 14·4$
                $= 43·2 \ mm^2$

$$\begin{array}{r} 14·4 \\ \times \ 3 \\ \hline 4\ 3·2 \end{array}$$

6. Gwen intends to sell her old computer.
She originally paid £500 for this computer.
Gwen enters the details on an internet selling website.

(a) Gwen would be happy to make a 35% loss.
How much money would Gwen receive if she made a 35% loss in selling her computer?
[2]

$$10\% \text{ of } 500 = 50$$
$$\boxed{30\%} \text{ of } 500 = 3 \times 50 = 150$$
$$\boxed{5\%} \text{ of } 500 = 50 \div 2 = 25$$
$$\therefore 35\% \text{ of } 500 = 150 + 25$$
$$= £175 \text{ loss}$$

$$\therefore \text{ She would receive } 500 - 175$$
$$= £325$$

(b) Gwen is offered £200 for her computer.
What is the percentage loss if she sells at this price?
[2]

$$500 - 200 = £300 \text{ loss}$$
$$\therefore \text{ fraction loss } = \frac{300}{500} \quad \div 5$$
$$\div 5$$
$$= \frac{60}{100}$$
$$= 60\%$$

Loss is ......60...... %

7. *(a)* The nth term of a sequence is $3n^2 - n$.
Write down the first three terms of the sequence. [2]

$\underline{n=1}$ $3(1^2) - (1)$ $\underline{n=2}$ $\underline{n=3}$

$= 3 - 1$ $3(2^2) - (2)$ $3(3^2) - (3)$

$= 2$ $= 12 - 2$ $= 27 - 3$

             $= 10$ $= 24$

(b) Find the nth term of each of the following sequences.

(i)   7, 18, 29, 40, 51, …. [2]

$+11 \quad +11 \quad +11 \quad +11$

$$11n - 4$$

(ii) -2, 1, 6, 13, 22, 33, …. [2]

$+3 \quad +5 \quad +7 \quad +9 \quad +11$
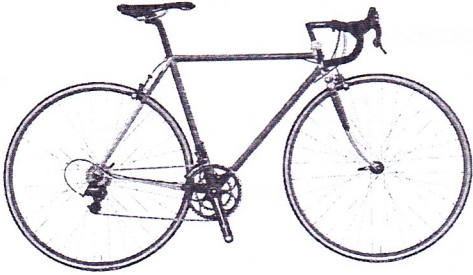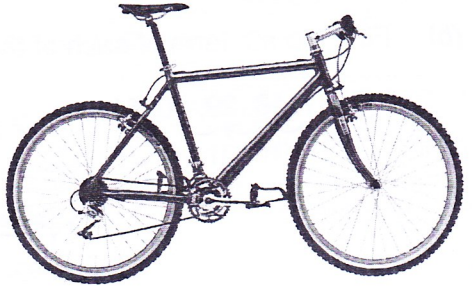
$+2 \quad +2 \quad +2 \quad +2$ ← 2nd difference all $+2$ $\therefore n^2$

$$n^2 - 3$$

Turn over.

8. *You will be assessed on the* quality of your written communication in this question.

During the year, both Lara and Glyn paid for new bikes.
The costs of the bikes are given below.

Lara bought the Lex8E and Glyn bought the Harrier2.

Lex8E	Harrier2
A single payment of £125 plus 11 monthly payments of £23	Payments made in February, June and October in the ratio 2 : 5 : 8 The **largest** payment is £248

Who paid more for their new bike, and by how much? [8]
You must show all your working.

Lara : Lex8E

$$Cost = 125 + (23 \times 11)$$
$$= 125 + 253$$
$$= £378$$

Glyn : Harrier2

8 parts = 248
1 part = 31 $\left(\dfrac{248}{8}\right)$
15 parts = 15 × 31

TOTAL   31 × 10 = 310
COST   31 × 5 = 155

∴ 31 × 15 = £465

∴ Cost for Glyn = £465

∴ Glyn paid more by 465 − 378
= £87

9. The table shows some of the values of $y = x^2 + 10x$ for values of x from -4 to 3.

x	-4	-3	-2	-1	0	1	2	3
$y = x^2 + 10x$	-24	-21	-16	-9	0	11	24	39

(a) Complete the table above.

[2]

$$\underline{x = -2}$$
$$y = (-2)^2 + 10(-2)$$
$$y = 4 - 20 = -16$$

$$\underline{x = 2}$$
$$y = 2^2 + 10(2)$$
$$y = 4 + 20$$
$$y = 24$$

(b) On the graph paper, draw the graph of $y = x^2 + 10x$ for the values of x from -4 to 3.   [2]
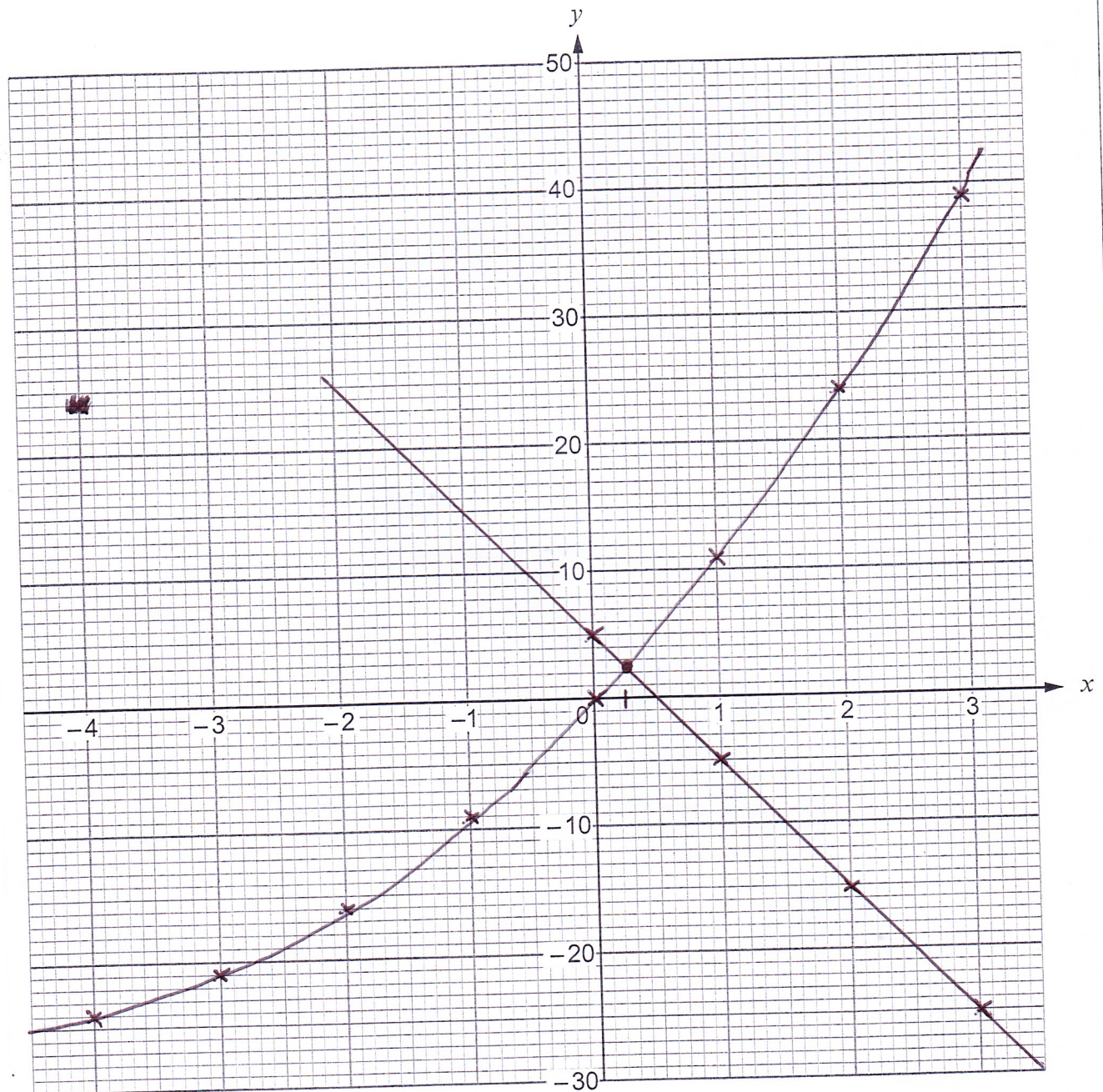
(c) (i) On the same axes, draw the graph of $y = -10x + 5$. [2]

x	0	1	2	3
y	5	-5	-15	-25

(ii) Hence, write down the coordinates of the point of intersection of $y = x^2 + 10x$ and $y = -10x + 5$. [1]

(2·5 , 2·5)

(d) Marged states,
'The graphs of $y = -10x - 5$ and $y = -10x + 5$ are parallel.'

Is Marged correct?
Tick the appropriate box and give a reason for your answer. [1]

Yes ✓   No ☐

They both have the same gradient
$m = -10$

10. Make g the subject of the following formula.
You must simplify your answer. [3]

$$\sqrt{3g + f} = h^2$$

square both $3g + f = h^4$

$3g = h^4 - f$

$g = \dfrac{h^4 - f}{3}$

11. Evaluate $2·34 \times 10^{13} + 1·6 \times 10^{12}$.
Give your answer in standard form. [2]

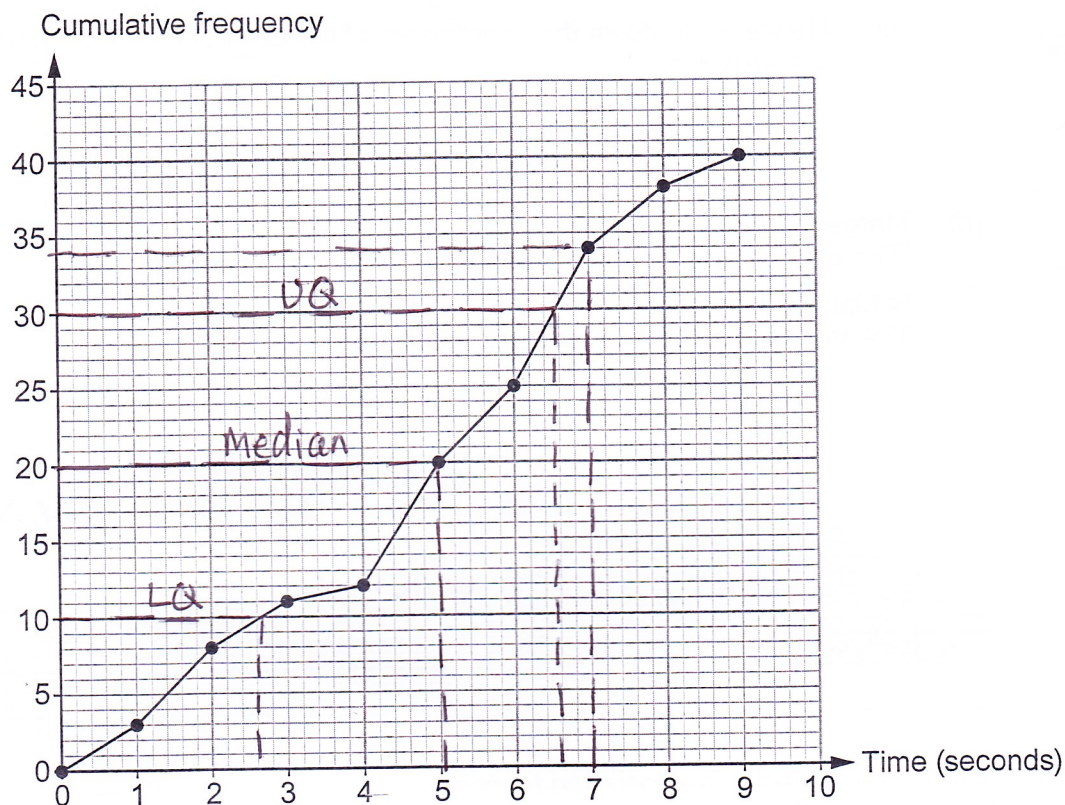$2·34 \times 10^{13} + 0·16 \times 10^{13}$

$= 2·5 \times 10^{13}$

12. *Yellow Sky* is a hockey team.
When a player scores a goal, the time taken by the player, from gaining possession of the ball to scoring the goal, is recorded.
In one season, *Yellow Sky* scored 40 goals.
The details can be seen in the cumulative frequency diagram below.

(a) For what percentage of the goals scored did the player have possession of the ball for more than 7 seconds? [3]

34 goals saw a player having possession for less than
∴ 6 goals saw player having possession for more tha

∴ $\frac{6}{40} = \frac{60}{400} = \frac{15}{100}$

15 %

(b) What is the median time from gaining possession of the ball to scoring a goal? [1]

Median time is ....5............ seconds

20'th result

(c) Calculate the interquartile range of the times from gaining possession of the ball to scoring a goal. [2]

LQ is 10'th goal = 2·6 secs

UQ is 30'th goal = 6·6 secs

IQR = 6·6 − 2·6

Interquartile range is ....4........ seconds

(d) *Noir Dust* is another hockey team.
Noir Dust's interquartile range of the times from gaining possession of the ball to scoring a goal is 5·9 seconds.
On average, the scorers from which team spent less time from gaining possession of the ball to scoring a goal?

Tick the appropriate box.

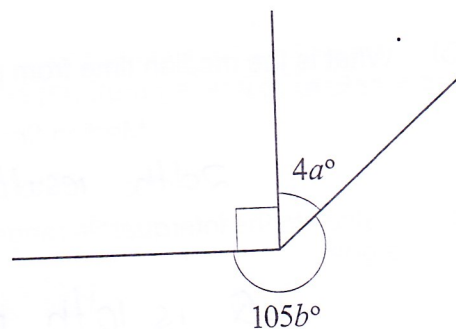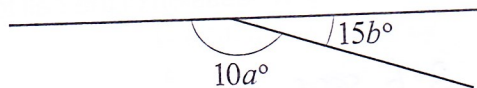Yellow Sky ☐   Noir Dust ☐   Can't tell ☑

Give a reason for your answer. [1]

The IQR is a measure of spread of data. You need the median values as well as IQR to make this deduction.

13.

$4a°$

$/15b°$

$10a°$

$105b°$

Diagrams not drawn to scale

[6]

Use an algebraic method to calculate the values of a and b.

First diagram $10a + 15b = 180$

$\div 5$ $2a + 3b = 36$ ———— ① × 2

Second diagram $4a + 105b + 90 = 360$

$4a + 105b = 270$ ———— ② × 1

$4a + 6b = 72$

$-4a + 105b = 270$

change sign   ADD $-99b = -198$
bottom line
and ADD $198 = 99b$

$\dfrac{198}{99} = b$

$2° = b$

(4370-05)

Now ① ⇒ $2a + 3(2) = 36$

$2a + 6 = 36$

$2a = 30$

$a = 15^\circ$

$a =$ 15°
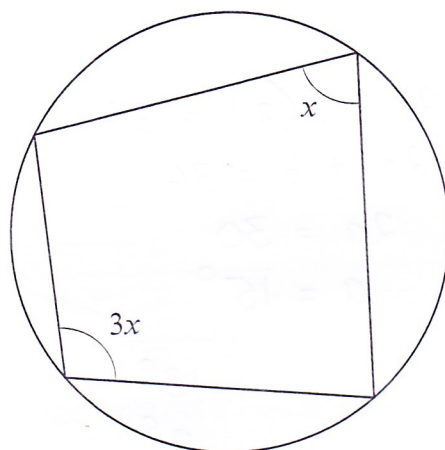
$b =$ 2°

Turn over.

14. *(a)*

Diagram not drawn to scale

[2]

Find the size of angle x.

$$x + 3x = 180° \qquad \text{for cyclic quad}$$
$$4x = 180$$
$$x = \frac{180}{4}$$
$$x = 45°$$

(4370-05)

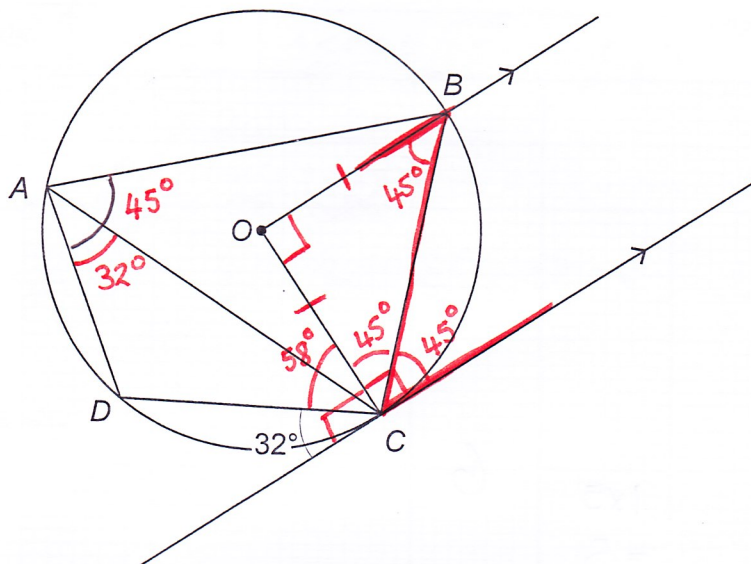(b)   In the diagram, O is the centre of the circle and OB is parallel to the tangent at C.

Diagram not drawn to scale

Calculate the size of $D\hat{A}B$.
You must indicate any angles you calculate.

[4]

$D\hat{A}C = 32°$ using alternate segment theorem

Then using tangent to radius = $90°$, $\angle$ alternate angles equal

and $\triangle BOC$ is isosceles   we get the $45°$ angles marked.

$\therefore B\hat{O}C = 180 \overset{-45-45}{} = 90°$

$\therefore B\hat{A}C = 90 \div 2 = 45°$

$\therefore D\hat{A}B = 45 + 32 = 77°$

$D\hat{A}B = \underline{\quad 77 \quad}°$

15. (a) At a supermarket, the time taken for customers to scan 5 items at a self-checkout was recorded.
A histogram that illustrates the results is shown below.
Unfortunately, the scale on the frequency density axis is missing.

Frequency density

Handwritten on graph:
- 0·4 × 7·5 = 3
- 1 × 5 = 5
- 6
- 0·1 × 10 = 1

Time, t (seconds)

Handwritten at left:
$0·4 \times 7·5$
$= 4 \times 0·75$
$= 2 \times 1·5$
$= 3$
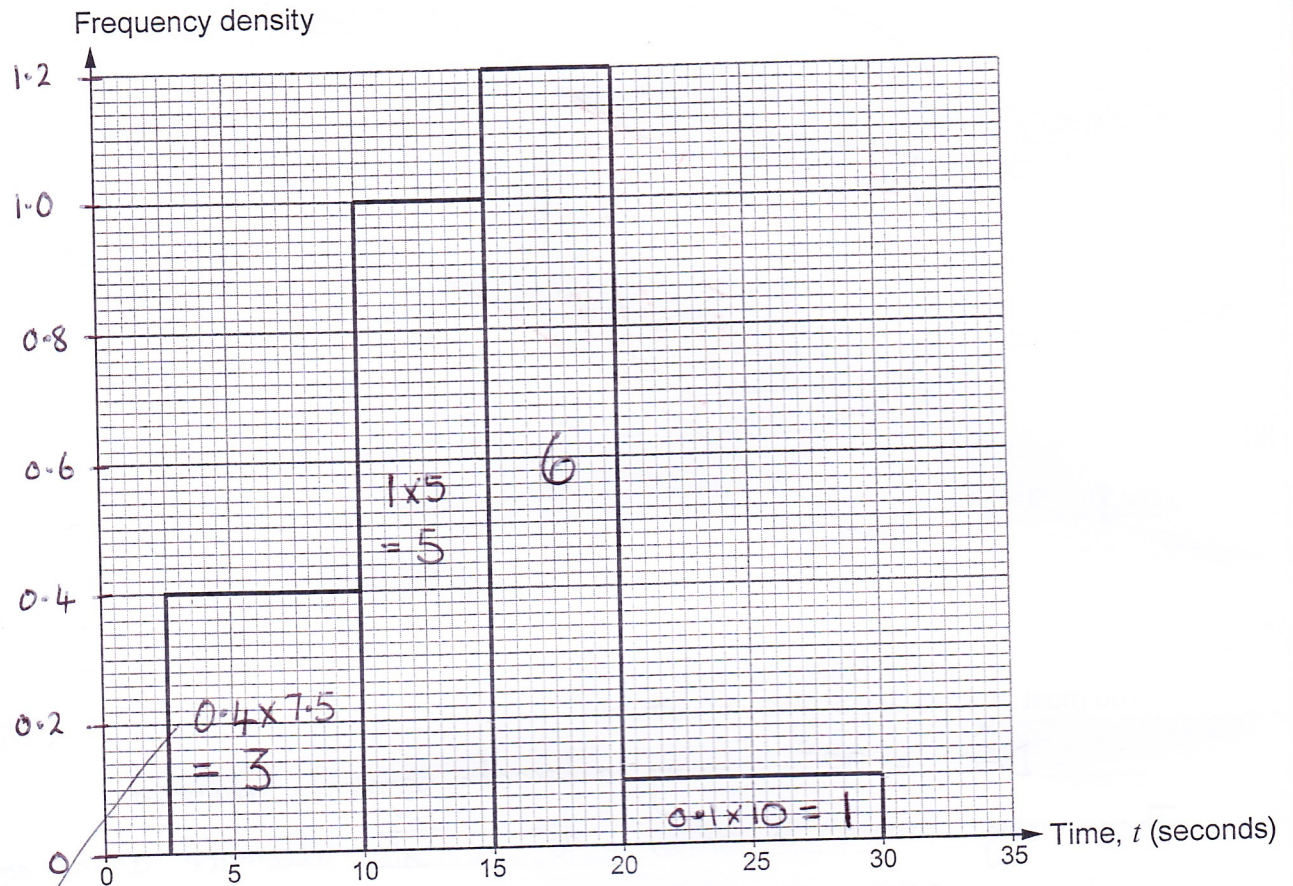
It is known that 6 people took between 15 and 20 seconds to scan their 5 items.

(i) Complete the scale on the frequency density axis. [3]

15 to 20 bar $A = lw$
$6 = l \times 5$
$\frac{6}{5} = l$
$1·2 = $ height of bar

∴ Go up in 0·2 stages

(ii) How many people were timed scanning their 5 items? [2]

$3 + 5 + 6 + 1$
$= 15$

(4370-05)

Examiner only

(b)   The time taken for staff to scan 5 items was also recorded.
The table below shows the results.

width *Area*

Time, t (seconds)	$0 < t \leqslant 4$	$4 < t \leqslant 8$	$8 < t \leqslant 12$	$12 < t \leqslant 16$	$16 < t \leqslant 24$
Number of staff	0	2	24	8	4

Complete the scale on the frequency density axis and draw a histogram to illustrate the distribution on the graph paper below.
[3]

HEIGHTS = $\frac{0}{4} = 0$ $\frac{2}{4} = 0.5$ $\frac{24}{4} = 6$ $\frac{8}{4} = 2$ $\frac{4}{8} = 0.5$

OF BARS

(Freq Density)

Frequency density
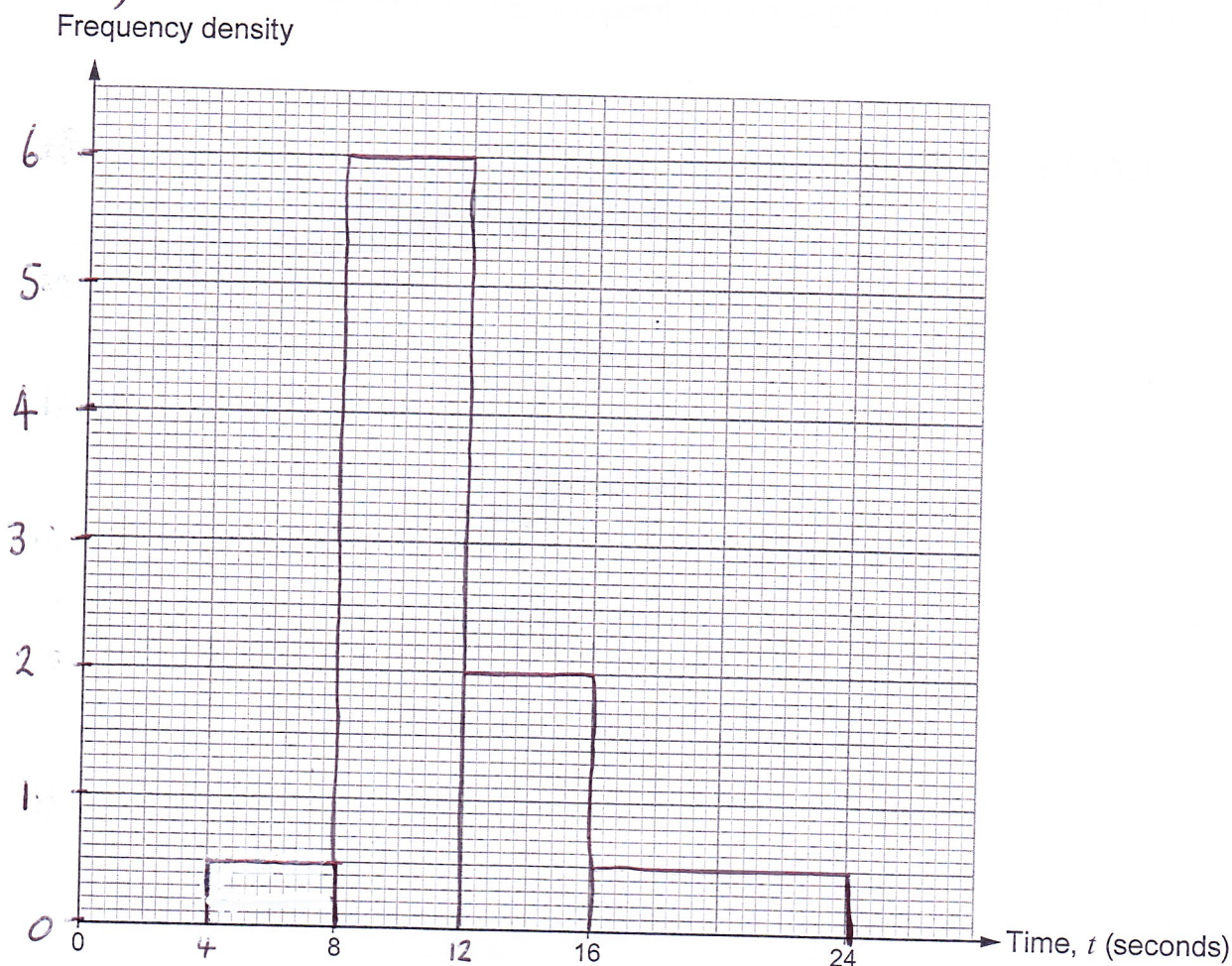
(c)   On average, which of the two groups of people, customers or staff, were quicker at scanning 5 items?
Tick the appropriate box.

Customers ☐   Staff ✓

You must use the histograms to explain your answer.
[1]

Greater area proportion at higher times for customer histogram.

© WJEC CBAC Ltd.   (4370-05)   **Turn over.**

[2]

16. *(a)* Express $0.8\dot{5}\dot{5}$ as a fraction.

$$\text{Let} \quad x = 0.8\dot{5}\dot{5}$$

$\times 100 \qquad 100x = 85.8\dot{5}\dot{5}$

$\underline{\text{subtract}} \quad \therefore \quad 90x = 85$

$$x = \frac{85}{90}$$

$$x = \frac{17}{18}$$

[3]

(b) Express the following as a single fraction in its simplest form.

$$\frac{3}{4} + \frac{1}{2x+7}$$

$$\text{LCM} = 4(2x+7)$$

$$= \frac{3(2x+7)}{4(2x+7)} + \frac{4(1)}{4(2x+7)}$$

$$= \frac{6x+21+4}{4(2x+7)}$$

$$= \frac{6x+25}{4(2x+7)}$$

(c) Evaluate $\left(\sqrt{75} - \sqrt{3}\right)^2$.   [3]

$$= \left(\sqrt{25}\sqrt{3} - \sqrt{3}\right)^2$$

$$= \left(5\sqrt{3} - \sqrt{3}\right)^2$$

$$= \left(4\sqrt{3}\right)^2$$

$$= 4\sqrt{3} \times 4\sqrt{3}$$

$$= 16 \times 3$$

$$= 48$$

17. Nesta has drawn the diagram shown below.
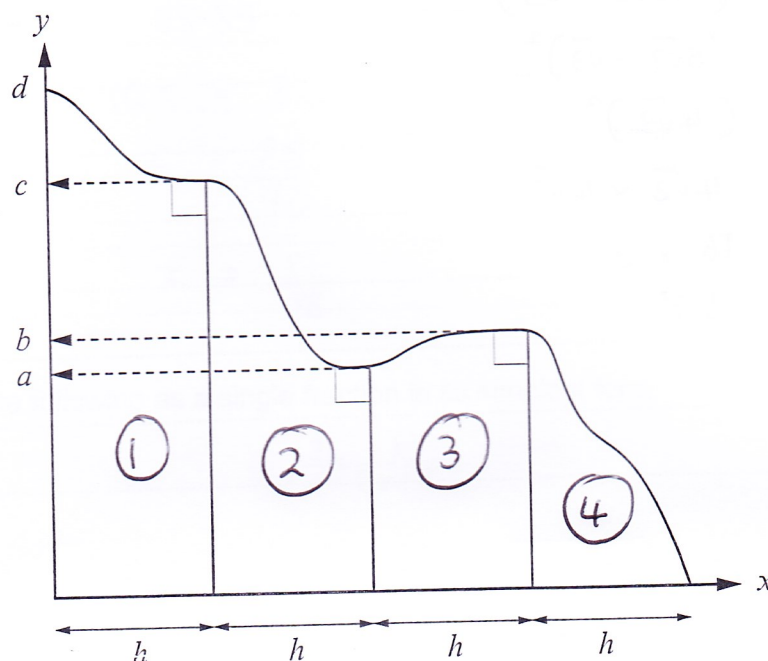She needs to estimate the area, A, of the region bounded by the axes and curve.

Diagram not drawn to scale

(a) Nesta doesn't consider using trapeziums to work out an estimate of the area.
Her estimate for the area is

$$A = ch + ah + bh + \frac{1}{2}bh$$

Explain how Nesta may have worked out her formula.   [2]

Nesta has used rectangle areas for the 1st 3 strips and then a triangle area for the last strip.

(5) Nesta's friend, Rikka, states that another estimate for A could be found by splitting the region into trapeziums and a triangle.

Rikka's estimate for the area is:

$$A = \frac{1}{2}hd + h(a+b+c)$$

Show that Rikka's formula is correct.
You must show all your working.

[5]

$$\text{Area} = \textcircled{1} + \textcircled{2} + \textcircled{3} + \textcircled{4}$$

$$= \frac{(d+c)h}{2} + \frac{(c+a)h}{2} + \frac{(a+b)h}{2} + \frac{bh}{2}$$

expand the bracket and split into 2 separate fractions

$$= \frac{dh}{2} + \frac{ch}{2} + \frac{ch}{2} + \frac{ah}{2} + \frac{ah}{2} + \frac{bh}{2} + \frac{bh}{2}$$

$$= \frac{dh}{2} + \boxed{\frac{ch}{2} + \frac{ch}{2}} + \boxed{\frac{ah}{2} + \frac{ah}{2}} + \boxed{\frac{bh}{2} + \frac{bh}{2}}$$

$$= \frac{dh}{2} + ch + ah + bh$$

↓ common factor h

$$= \frac{1}{2}dh + h(a+b+c)$$

END OF PAPER