

Mental Arithmetic Questions

1. What number is five cubed?

$$5 \times 5 \times 5 = \mathbf{125}$$

2. A circle has radius  $r$ .

What is the formula for the area of the circle?

Area =  $\pi \times \text{radius} \times \text{radius}$

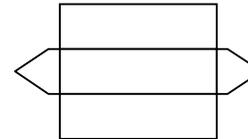
$$= \mathbf{\pi r^2}$$

3. Jenny and Mark share some money in the ratio two to three. Jenny's share is one hundred and ten pounds. How much is Mark's share?

$$\begin{array}{ccc} \times 55 & \begin{array}{c} \curvearrowright \\ 2 : 3 \\ \curvearrowleft \end{array} & \times 55 \\ & 110 & \end{array}$$

**£165**

4. The net of a triangular prism is made from triangles and rectangles. How many of each shape are needed?



3 Rectangles

2 Triangles

5. Multiply minus six by minus two.

$$-6 \times -2 = \mathbf{12}$$

**KS3 MATHEMATICS**

**10 4 10**

Level 8 Mental Arithmetic Questions

**Answers**

**Day 1**

## Births

The table shows data about births in the UK.

Year	Number of Births
1910	$1.05 \times 10^6$
1920	$1.13 \times 10^6$
1930	$7.69 \times 10^5$
1940	$7.02 \times 10^5$
1950	$8.18 \times 10^5$
1960	$9.18 \times 10^5$
1970	$9.04 \times 10^5$
1980	$7.54 \times 10^5$
1990	$7.99 \times 10^5$

- (a) In which year was the number of births the highest?  
 $1.13 \times 10^6$

1920

*1 mark*

- (b) How many more births were there in 1990 than in 1980?

Show your working and write your answer in **standard form**.

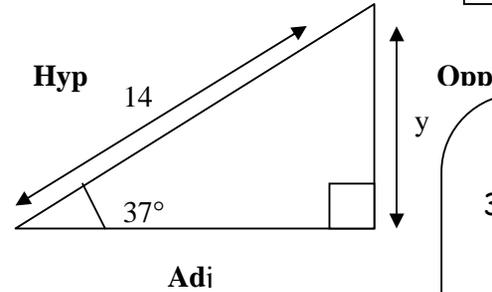
$$7.99 \times 10^5 - 7.54 \times 10^5 = 45000$$

$$4.5 \times 10^4$$

*2 marks*

## Trigonometry

- (a) Calculate the value of  $y$   
 Show your working.



- 1.) Label sides Opp, Adj, Hyp
- 2.) Identify the 2 sides to use

Not drawn accurately

- 3.) Identify trig ratio where  $\text{Sin} = \frac{\text{Opp}}{\text{Hyp}}$

$$\text{Sin } 37 = \frac{y}{14}$$

$$14 \text{ Sin } 37 = y$$

$$8.4254 = y$$

$$8.4 \text{ to 1 d.p.} = y$$

Sin Opp = 12 Hyp = 15  
 Angle =  $50^\circ$

Does  $\text{Sin } 50^\circ = \frac{12}{15}$ ?

$\text{Sin } 50^\circ = 0.766044$

$\frac{12}{15} = 0.8$

$\therefore \text{Sin } 50^\circ \neq \frac{12}{15}$

YES  NO

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Level 8 Mental Arithmetic Questions

**Answers**

**Day 2**

**Mental Questions**

1. What is one third of three quarters of one hundred?

$$\frac{1}{3} \times \left[ \frac{3}{4} \times 100 \right] = \frac{1}{3} \text{ of } 75 = 25$$

2. I'm thinking of a number. I call it  $n$ .  
I square my number then add four.  
Write an expression to show the result.

$$n^2 + 4$$

3. Twenty-one out of thirty-six pupils said they watched  
Top of The Pops.  
What angle would show this on a pie chart?

$$1 \text{ pupil} = \frac{360^\circ}{36} = 10^\circ \quad \therefore 21 \text{ pupils} = 21 \times 10 = 210^\circ$$

4. There are seven red and three blue balls in a bag.  
I am going to take a ball out of the bag at random.  
What is the probability that the ball will be blue?

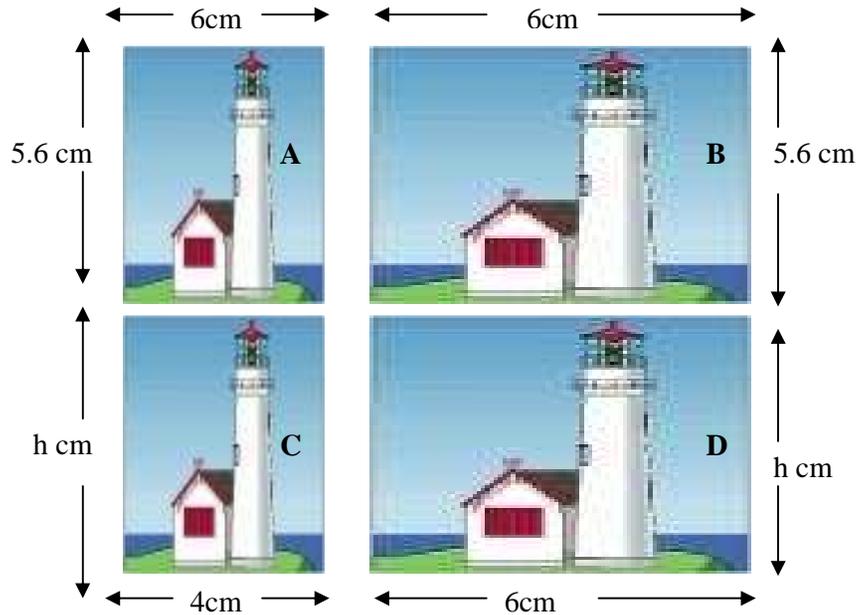
$$\frac{\text{No of Blue}}{\text{Total}} = \frac{3}{10}$$

5. Write a multiple of three that is bigger than one  
hundred.

102, 105, 108, ..... or other

## Enlargement

Here are four pictures, A, B, C and D. They are not to scale.



- (a) Picture A can be stretched horizontally to make picture B. Show that the horizontal factor of enlargement is 1.5

$$\frac{\text{Horizontal length B}}{\text{Horizontal length A}} = \frac{6}{4} = 1\frac{2}{4} = 1.5$$

1 mark

- (b) Picture A can be stretched vertically to make picture C. The vertical factor of enlargement is 1.25

What is the height, h, of picture C?

$$L = 5.6 \times 1.25 = 7\text{cm}$$

1 mark

- (c) Show that pictures A and D are not mathematically similar.

$$\text{A Horizontal } 4 \quad \text{D Horizontal } 6 \quad \therefore \text{SF} = \frac{6}{4} = 1.5$$

$$\text{A Vertical } 5.6 \quad \text{D Vertical } 7 \quad \therefore \text{SF} = 1.25$$

$\therefore$  Lengths have been enlarged with different S.F.

1 mark

- (d) Picture E (not shown) is mathematically similar to picture A. The width of picture E is 3cm. What is the height of picture E?

A Width 4	E width 3	SF = $\frac{3}{4}$
A Height 5.6	E Height $5.6 \times \frac{3}{4} = 4.2\text{cm}$	

## Factors

- (a) Look at these equations.

$$48 = 3 \times 2^a \quad 56 = 7 \times 2^b$$

What are the values of a & b?

$$48 = 3 \times 16 \quad 56 = 7 \times 8$$

$$16 = 2^4 \quad 8 = 2^3$$

$$a = 4$$

$$b = 3$$

1 mark

- b)  $48 \times 56 = 3 \times 7 \times 2^c$

What is the value of c?

$$48 \times 56 = 3 \times 7 \times 24 \times 2$$

$$= 3 \times 7 \times 27$$

$$C = 7$$

1 mark

**KS3 MATHEMATICS**

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Level 8 Mental Arithmetic Questions

**Answers**

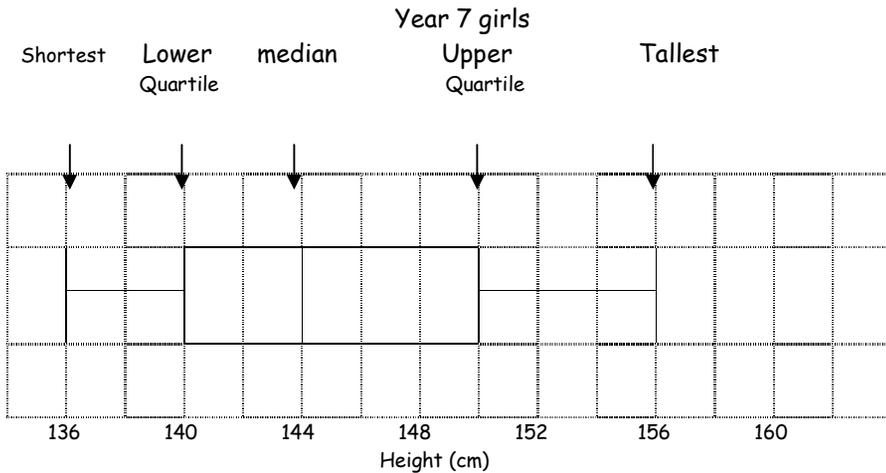
**Day 3**

**Mental Questions**

1. I am thinking of a number. I call it  $n$ .  
I double my number then I subtract three.  
Write an expression to show the result.  
 $n$  double it =  $2n$   
Subtract 3           $2n - 3$
2. What percentage of fifty pounds is thirty-five pounds?  
 $\frac{35}{50} \times 100 = 70\%$
3. On average, the driest place on earth gets only nought point five millimetres of rain every year.     $0.5\text{m}$  or  $\frac{1}{2}$   
In total, how much rain would it expect to get in twenty years?  
 $0.5 \times 20 = 10\text{mm}$
4. To the nearest whole number, what is the square root of eighty-three point nine?  
 $83.9 \approx 81 \therefore \sqrt{81} = 9$
5. It takes me one and a half minutes to swim one length of the pool.  
How many lengths can I swim in fifteen minutes?  
 $15 / 1.5$   
 $1.5 \times 10 = 15 \therefore 10 \text{ lengths}$

## Box Plots

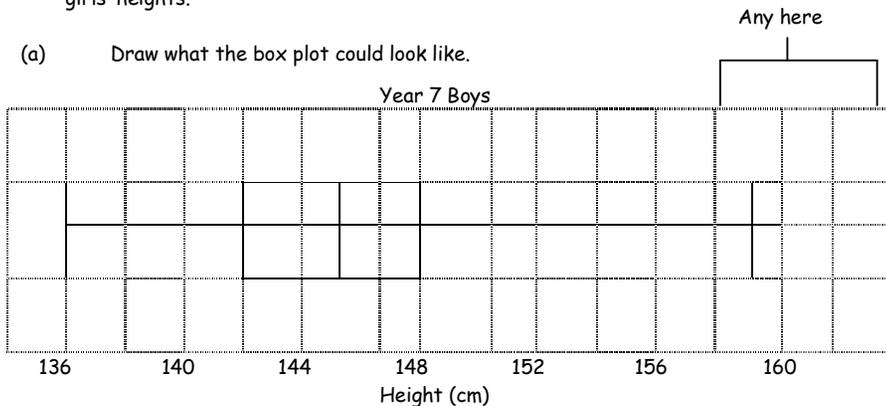
A pupil recorded the heights of all the girls in year 7. She summarised her results, then drew this box plot



The pupil compared the heights of year 7 boys with year 7 girls

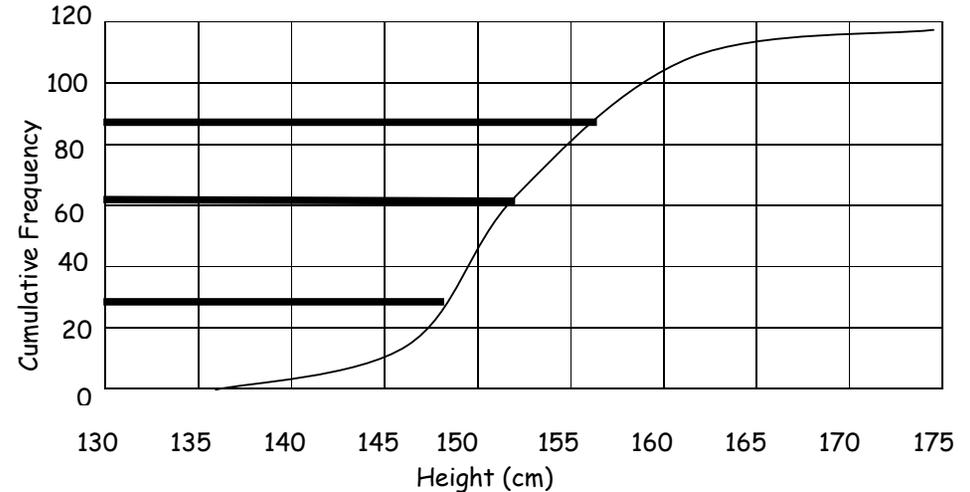
- The shortest boy was the same height as the shortest girl;
- The range of boys' heights was smaller than the inter-quartile range of girls' heights;
- The inter-quartile range of boys' heights was smaller than the inter-quartile range of girls' heights.

(a) Draw what the box plot could look like.



There are 120 girls in year 9

The cumulative frequency diagram shows information about their heights



(b) Compare the heights of year 9 girls with year 7 girls

Y9	Lowest	135		Y7	36
	QL	149.5			140
	M	153	} IQR = 7.5		144
	Qu	157			150
	Highest	175			156
					} 10

3 Statements from: -

The range of heights for Y9 is bigger

The IQR is higher for Y7 than Y9

The shortest girl in Y7 is about the same height as the shortest boy in Y9

The median in Y9 is higher in Y7

Less variability in middle 50% in Y9

**KS3 MATHEMATICS**

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Level 8 Mental Arithmetic Questions  
Answers

**Day 4**

**Mental Questions**

1. Tariq won one hundred pounds in a maths competition. He gave two-fifths of his prize money to charity. How much of his prize money, in pounds did he have left?

$$1 - \frac{2}{5} = \frac{3}{5} \quad \frac{3}{5} \text{ of } \pounds 100$$

$$\frac{1}{5} = \pounds 20 \quad \frac{3}{5} = 3 \times 20 = \pounds 60$$

2. What is three point nine divided by two?

$$3.9 \div 2 \quad 3 \div 2 = 1.5$$

$$0.9 \div 2 = \underline{0.45}$$
$$1.95$$

3. The instructions for a fruit drink say to mix one part blackcurrant juice with four parts water. I want to make one litre of this fruit drink. How much blackcurrant juice should I use? Give your answer in millimetres.

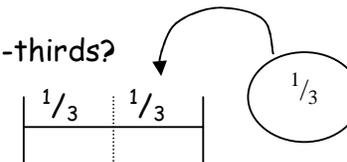
$$1 \text{ part } \therefore 4 \text{ parts } 1000\text{ml} = 1 \text{ litre}$$

$$5 \text{ parts in } 1000\text{ml} \therefore \text{each } \frac{1000}{5} = 200\text{ml}$$

$\therefore$  200ml of blackcurrant per part

4. What is half of two-thirds?

$$\frac{1}{2} \text{ of } \frac{2}{3}$$

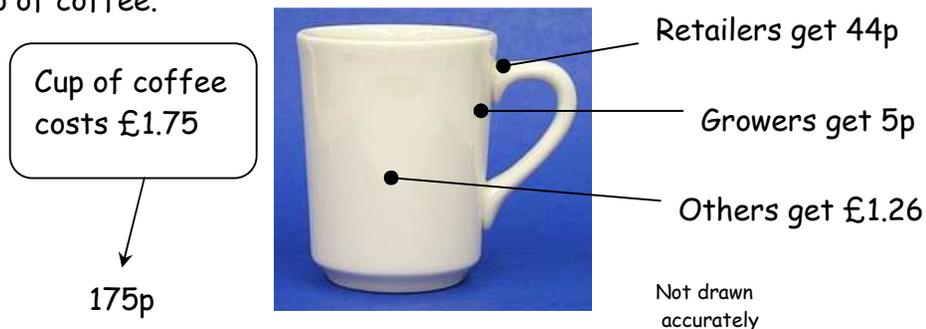


5. The population of the United Kingdom is about fifty nine million. Write this number in figures

59 000 000

A cup of coffee costs £1.75

The diagram shows how much money different people get when you buy a cup of coffee.



(a) Complete the table to show what percentage of the cost of a cup of coffee goes to retailers, growers and others.

Show your working

44p out of 175p

$$\frac{44}{175} \times 100 = 25.1\%$$

$$\frac{5}{175} \times 100 = 2.9\%$$

$$\frac{126}{175} \times 100 = 72$$

Retailers	25.1%	25.14%	25%
Growers	2.9%	2.86%	3%
Others	72%	72%	72%

Must add to 100

2 marks

(b) Some people think the growers should get more. Suppose the percentages change to:

Retailers	23%
Growers	10%
Others	67%

Suppose the retailers still got 44p from each cup of coffee sold.

How much would a cup of coffee cost?

Show your working.

$$23\% = 44\text{p}$$

$$1\% = \frac{44}{23} = 1.91$$

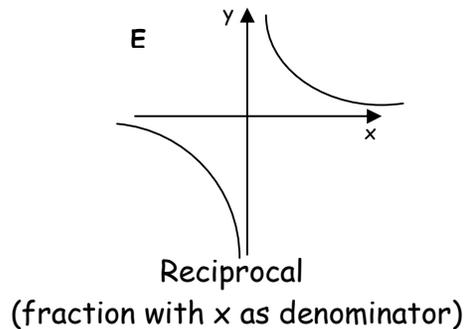
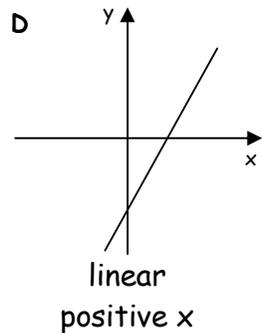
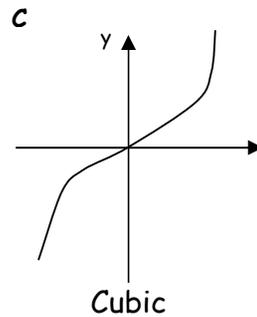
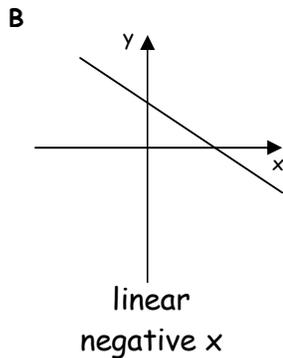
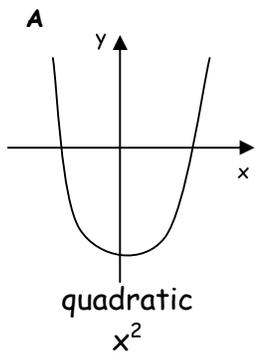
$$100\% = \frac{44}{23} \times 100 = £191.30$$

£1.91

2 marks

## Graphs

Match each graph to the correct equation.



Graph .....D..... shows the equation  $y = 2x - 6$

Graph .....C..... shows the equation  $y = 6x^3$

Graph .....B..... shows the equation  $y = 6 - x$

Graph .....A..... shows the equation  $y = x^2 - 6$

Graph .....E..... shows the equation  $y = \frac{1}{6x}$

2 marks

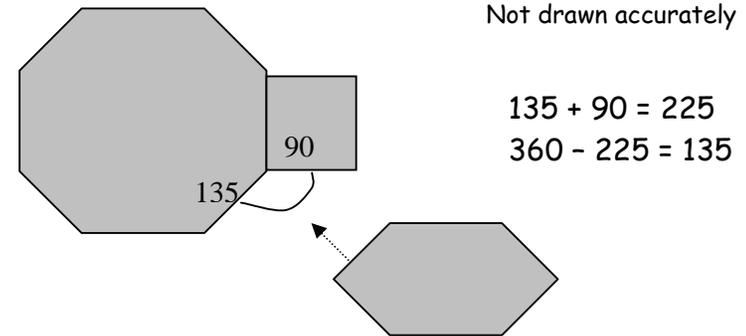
## Tiles

A pupil has three tiles.

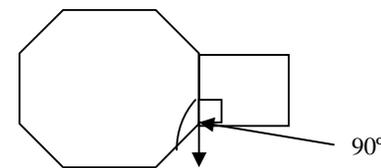
One is a regular octagon, one is a regular hexagon, and one is a square.

The side length of each tile is the same.

The pupil says the hexagon will fit exactly like this.



Show calculations to prove that the pupil is **wrong**.



Total Interior angle of Octagon  
 $= 180 \times (n - 2)$   
 $= 180 \times 6$   
 $= 1080$   
 Each angle  $= 1080 \div 8$   
 $= 135^\circ$

Need  $135^\circ$  or Octagon to fit.

Hexagon total interior angles  
 $= 180 \times (n - 2)$   
 $= 180 \times 4$   
 $= 720$

Each angle  $= \frac{720}{6} = 120^\circ$

Not Big Enough

3 marks

**KS3 MATHEMATICS**

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Level 8 Mental Arithmetic Questions  
**Answers**

**Day 5**

**Mental Questions**

1. What is three-fifths of forty pounds?

$$\frac{1}{5} \text{ of } \pounds 40 = \pounds 8 \text{ so } \frac{3}{5} \text{ is } 3 \times 8 = \pounds 24$$

2. The longest bone in the human body is in the leg. The average length of this bone in a man is fifty centimetres. In a woman it is ten percent less. What is the average length of this bone in a woman?

$$\begin{array}{ll} 50\text{cm} & 10\% \text{ less than } 50\text{cm} \\ 10\% \text{ of } 50 = 5 & \therefore 50 - 5 = 45\text{cm} \end{array}$$

$$\text{or woman is } 100\% - 10\% = 90\% \quad 90\% \text{ of } 50 = 45\text{cm}$$

3. Using three as an approximation for pi, what is the area of a circle with radius five centimetres?

$$A = \pi \times r^2 = 3 \times 5^2 = 3 \times 25 = \mathbf{75\text{cm}^2}$$

4. I am thinking of a two-digit number that is a multiple of eight. The digits add up to six. What number am I thinking of?

$$\text{Multiples of } 8. \quad 16, 24, 32\dots \quad 2 + 4 = 6 \quad = \mathbf{24}$$

5. I am thinking of a number. I call it n. I add five to my number. Write an expression to show the result.

$$N + 5$$

## Plant Pots

These plant pots are mathematically similar. The internal dimensions are shown.



- (a) Calculate the value of  $m$ .

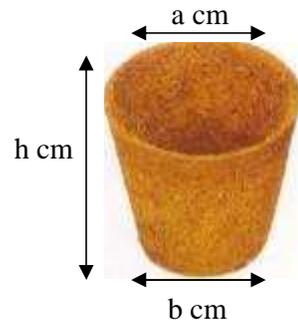
Show your working.

$$\begin{array}{ccc} \div 60 \times 42 & \begin{array}{c} \text{Small: Large} \\ 40 : 60 \\ m : 42 \end{array} & \div 60 \times 42 \end{array}$$

$$\frac{40}{60} \times 42 = m = 28\text{cm}$$

- (b) The capacity,  $C$ , of a plant pot in cubic centimetres is given by the formula:

$$C = \frac{1}{12} \pi h (a^2 + ab + b^2)$$



In the larger plant pot  $a = 60$ ,  $b = 36$  and  $h = 42$   
How many litres of compost are needed to fill the plant pot?

Show your working out.

$$C = \frac{1}{12} \pi h (a^2 + ab + b^2)$$

$$= \frac{1}{12} \times \pi \times 42 (60^2 + 60 \times 36 + 36^2)$$

$$= \frac{1}{12} \times \pi \times 42 (3600 + 2160 + 1296)$$

$$= \frac{1}{12} \times \pi \times 42 \times 7056$$

$$= 77584.77217$$

77584cc litres

$$= 77584 \div 1000$$

$$= 77.6$$

Any value between 77.5 and 78 accepted

**3 marks**

- (c) Think about the ratio of the widths of the two plant pots.  
Explain why the ratio of the capacity of the smaller pot to the capacity of the larger pot is 8 : 27

$$40 : 60$$

Simplify

$$2 : 3$$

For area we square the ratio.  $2^2 : 3^2$

For volume we cube the ratio  $2^3 : 3^3$

$$2^3 : 3^3$$

$$2^3 = 8$$

$$3^3 = 27$$

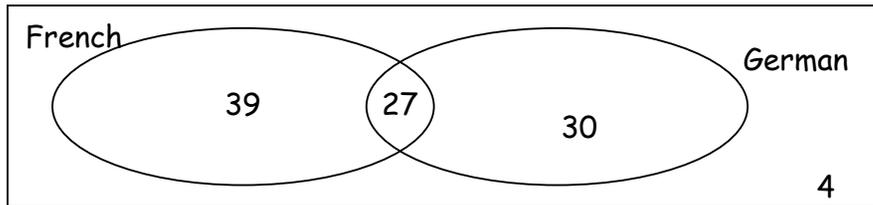
$$8 : 27$$

**1 mark**

## Languages

Probability is not accepted as a ration, you must write as fraction, decimal or %.

100 Students were asked whether they studied French or German



27 students studied both French and German

- (a) What is the probability that a student chosen at random will study only one of the languages?

39 only French + 30 only German

69 out of 100

69 or 0.69 or 69%

100

1 mark

- (b) What is the probability that a student who is studying German is also studying French?

27 speak German & French

57 speak German

1 mark

- (c) Two of the 100 students are chosen at random  
Circle the calculation, which shows the probability that both the students study French and German?

27/100 speak both if we take one out it leaves 26 out of 99

$$\frac{27}{100} \times \frac{26}{100}$$

$$\frac{27}{100} \times \frac{26}{100}$$

$$\frac{27}{100} \times \frac{26}{99}$$

$$\frac{27}{100} \times \frac{27}{100}$$

$$\frac{27}{100} \times \frac{27}{100}$$

1 mark

## Scores

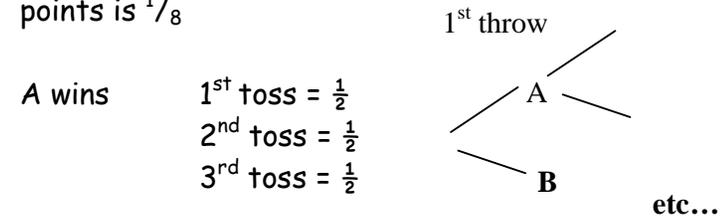
- (a) A fair coin is thrown. When it lands it shows heads or tails.

Game: Throw the coin three times.

Player A wins one point each time the coin shows a head.

Player B wins one point each time the coin shows a tail.

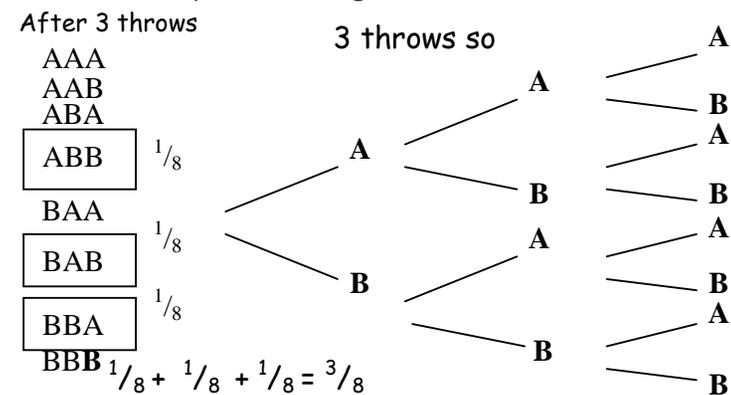
Show that the probability that a player A scores three points is  $\frac{1}{8}$



$$\frac{1}{2} \times \frac{1}{2} \times \frac{1}{2} = \frac{1}{8}$$

- (b) What is the probability that player B scores exactly two points?

Show your working.



2 marks

## Mental Questions

### KS3 MATHEMATICS

## 10 4 10

Level 8 Mental Arithmetic Questions  
Answers

### Day 6

1. Five percent of a number is 8. What is the number?

$$\begin{array}{l}
 \times 10 \\
 \times 2
 \end{array}
 \begin{array}{l}
 \curvearrowright \\
 \curvearrowright \\
 \curvearrowright
 \end{array}
 \begin{array}{l}
 5\% = 8 \\
 50\% = 80 \\
 100\% = \boxed{160}
 \end{array}
 \begin{array}{l}
 \curvearrowright \\
 \curvearrowright \\
 \curvearrowright
 \end{array}
 \begin{array}{l}
 10 \\
 \\
 \\
 \end{array}$$

2. A fair spinner has eight equal sections with a number on each section. Five of them are even numbers. Three are odd numbers. What is the probability that I spin an even number?

$$\frac{5}{8} - \frac{\text{no of even}}{\text{Total no.}}$$

3. I can make a three-digit number from the digits two, three and four in six different ways. How many of these three-digit numbers are even?

2, 3, 4

234	324	432	4 even
243	342	423	

4. What is the volume of a cuboid measuring five centimetres by six centimetres by seven centimetres?

$$\begin{aligned}
 L \times W \times H &= 5 \times 6 \times 7 \\
 &= 30 \times 7 = \mathbf{210}
 \end{aligned}$$

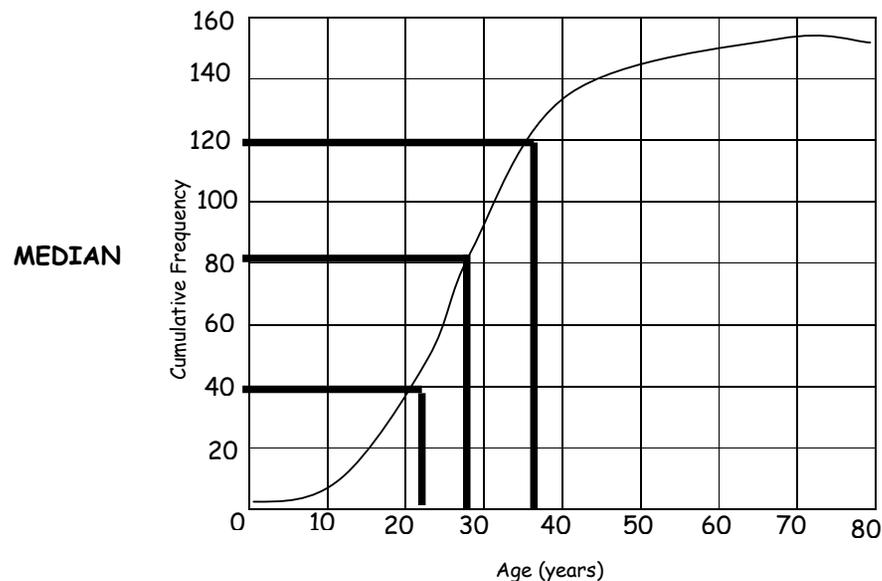
5. What is the remainder when you divide three hundred by twenty-nine?

$$\begin{array}{r}
 300 \\
 29 \times 10 = \underline{290} \\
 \hline
 10
 \end{array}
 \quad \therefore \mathbf{10 \text{ is remainder}}$$

## Theme Park

Tom did a survey of the age distribution of people at a theme park.  
He asked 160 people.

The cumulative frequency graph shows his results



- (a) Use the graph to estimate the median age of people at the theme park

$\frac{1}{2}$  of 160 people    MEDIAN = 28 years

1 mark

- (b) Use the graph to estimate the interquartile range of the age of people at the theme park.

Show your method on the graph

40 people Q1 = 36

$36 - 21 = 15$

120 people QU = 21

interquartile range = 15 years

2 marks

- (C) Tom did a similar survey at a flower show.

Results: The median age was 47 years

The interquartile range was 29 years

Compare the age distribution of the people at the flower show with that of the people at the theme park.

The median age at the flower show was much higher suggesting older people went to the flower show.

The middle 50% of people at the flower show had a larger spread of ages.

1 mark

## Eating

People were asked if they were considering changing what they eat.

29% of the people asked said yes

Of these, 23% said they were considering becoming vegetarian.

What percentage of the people asked said they were considering becoming vegetarian?

23% of 29%

$\frac{23}{100} \times \frac{29}{100} = \frac{667}{10000}$

or  $0.23 \times 0.29 = 0.0667$

1 mark

**KS3 MATHEMATICS**

**10 4 10**

Level 8 Mental Arithmetic Questions  
**Answers**

**Day 7**

**Mental Questions**

1. Twenty-five percent of a number is seven. What is the number?

$$\begin{array}{rclclcl} \times 2 & \curvearrowright & 25\% & \text{is} & 7 & \curvearrowleft & \times 2 \\ & & 50\% & \text{is} & 14 & & \\ \times 2 & \curvearrowright & 100\% & \text{is} & \boxed{28} & \curvearrowleft & \times 2 \end{array}$$

2. There are fourteen girls and thirteen boys in a class. What is the probability that a pupil chosen at random will be a girl?

$$\text{Total} = 14 + 13 = 27$$

$$\frac{\text{Girls}}{\text{Total}} = \frac{14}{27}$$

3. The first even number is two. What is the hundredth even number?

$$2 \times 100 = 200$$

4. The mean of two numbers is 8. One of the numbers is two. What is the other number?

$$\text{Total must be } 8 \times 2 = 16$$

$$? + 2 = 16 \therefore ? = 14$$

5. How many edges are there on a square based pyramid?

4 on base

4 on sides

$$= 8$$

## Tanks

On a farm many years ago the water tanks were filled using a bucket from a well.

- (a) The table shows the numbers of buckets, of different capacities, needed to fill a tank of capacity 2400 pints.

Complete the table

Capacity of bucket (pints)	8	10	12	15	16	24	30
Number of buckets	300	240	200	160	150	100	80

Each must multiply to 2400

3 marks

- (b) Write an equation using symbols to connect  $T$ , the capacity of the tank,  $B$ , the capacity of a bucket, and  $N$ , the number of buckets.

$$T = B \times N \quad \text{or} \quad T = BN$$

1 mark

- (c) Now tanks are filled through a hosepipe connected to a tap. The rate of flow through the hosepipe can be varied.

The tank capacity 4000 litres fills at a rate of 12.5 litres per minute. How long in hours and minutes does it take to fill the tank?

Show your working

2500 in 200 mins

1250 in 100 mins

3750

125 in 10 mins

3875

125 in 10mins

12.5 litres in 1 min

125 litres in 10 mins

1250 litres in 100 mins

2500 litres in 200 mins

320 mins = 5 hrs 20 mins

2 marks

- (d) Another tank took 5 hours to fill at a different rate of flow. How long would it have taken to fill this tank if this rate of flow had been increased by 100%?

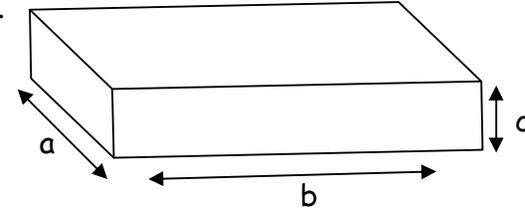
100% takes 5 hours

Double %  $\therefore \frac{1}{2}$  time

2 hours 30 minutes

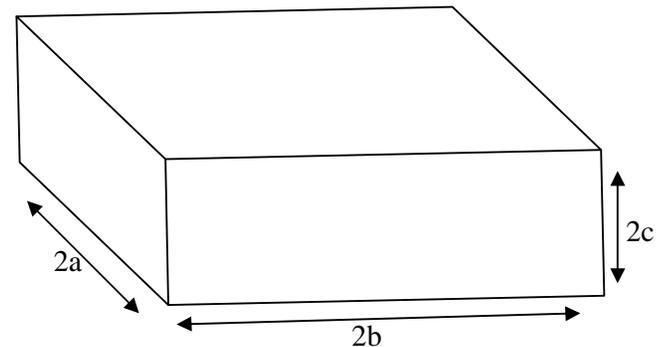
1 mark

- (e) This tank, measuring  $a$  by  $b$  by  $c$ , takes 1 hour 15 minutes to fill.



$a \times b \times c$   
takes 75 mins

How long does it take to fill  $2a$  by  $2b$  by  $2c$ , at the same rate of flow?



Show your working

$$2a \times 2b \times 2c$$

$8abc$  will take 8 x's longer

$$8 \times 75 = 600$$

$$600 \text{ mins} = 10 \text{ hrs}$$

2 marks

## Mental Questions

### KS3 MATHEMATICS

**10 4 10**

Level 8 Mental Arithmetic Questions  
Answers

**Day 8**

1. Multiply 8.7 by 2

$$8 \times 2 = 16$$

$$0.7 \times 2 = 1.4$$

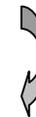
17.4

2. A bat flies at an average speed of 32 kilometres an hour. At this speed, how far will it fly in 15 minutes?

$$32\text{km} : 60\text{mins}$$

$$16\text{km} : 30\text{mins}$$

$$8\text{km} : 15\text{mins}$$



3. Multiply the brackets  $(2x + 1)(x - 1)$

	2x	1	
x	$2x^2$	x	$2x^2 + x - 2x - 1$
-1	-2x	-1	$2x^2 - 2x - 1$

4. I'm thinking of a number. I call it t. I half it and subtract five. Write an expression to show the result.

$$\frac{t}{7} - 5$$

5. The first odd number is 1 what is the hundredth odd number?

199

## Squares

Some numbers are smaller than their squares

For example:  $7 < 7^2$

(a) Which numbers are equal to their squares.

$$0^2 = 0 \quad \text{0 and 1}$$

$$1^2 = 1$$

2 marks

(b) Some numbers are bigger than their squares.

Describe this set of numbers.

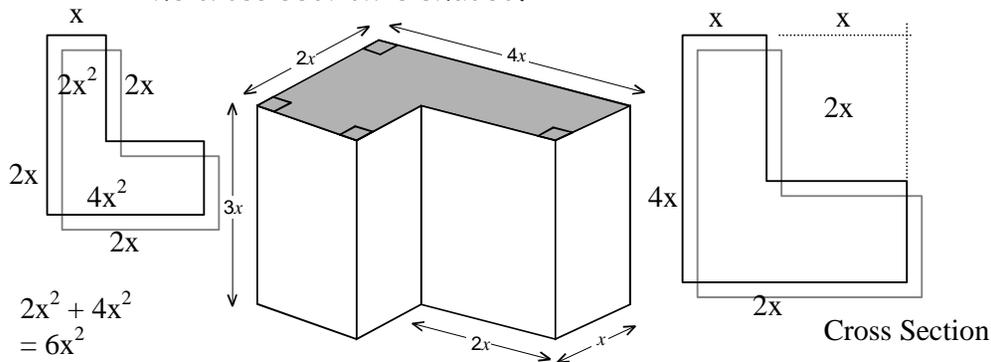
Numbers between 0 and 1

$$0 < x < 1$$

2 marks

## Expressions

(a) This solid is a prism, with height  $3x$ .  
The cross section is shaded.



$$2x^2 + 4x^2 = 6x^2$$

Write an expression for the volume of the prism.  $4x \times 2x = 8x^2$

Show your working and simplify your expression.

$$\text{Area of cross section} = 6x^2$$

$$\text{Volume} = 6x^2 \times 3x$$

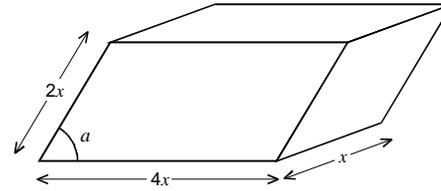
$$= 18x^3$$

2 marks

$$2x \times x = 2x^2$$

$$8x^2 - 2x^2 = 6x^2$$

The volume of this prism is given by the expression  $8x^3 \sin a$



NOT TO SCALE

(b) What value of (a) would make the volume of the prism  $8x^3$ ?

$$8x^3 \sin a = 8x^3$$

$$\sin a = 1$$

$$a = \sin^{-1} 1$$

$$a = 90^\circ$$

1 mark

(c) = The prism has a volume of  $500\text{cm}^3$ .  
The value of (a) is  $30^\circ$

What is the value of x?

Show your working.

$$8x^3 \sin a = 500$$

$$8x^3 \sin 30 = 500$$

$$x^3 = \frac{500}{8}$$

$$8 \sin 30$$

$$x = \sqrt[3]{\frac{500}{8}}$$

$$8 \sin 30$$

$$= \sqrt[3]{125}$$

$$= 5$$

2 marks

## Algebraic expressions

Look at these expressions

$$5y - 8$$

First  
Expression

$$3y + 5$$

Second  
Expression

- (a) What value  $y$  of makes the two expressions equal?

Show your working.

$$5y - 8 = 3y + 5$$

$$5y = 3y + 5 + 8$$

$$5y - 3y = 13$$

$$2y = 13$$

$$y = \underline{6.5}$$

*2 marks*

- (b) What value of  $y$  makes the first expression twice as great as the second expression?

Show your working.

$$2 \text{ lots of } y \quad 3y + 5$$

$$\text{is same as } 5y - 8$$

$$5y - 8 = 3y + 5 + 3y + 5$$

$$5y - 8 = 6y + 10$$

$$5y - 8 - 10 = 6y$$

$$-18 = 6y - 5y$$

$$y = \underline{-18}$$

*2 marks*

**KS3 MATHEMATICS**

**10 4 10**

Level 8 Mental Arithmetic Questions  
**Answers**

**Day 9**

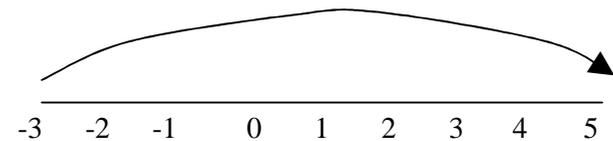
**Mental Arithmetic Questions**

1. Add four to minus five.

$$-5 + 4 = -1$$

Think of number line or thermometer

2. What number should you add to minus three to get the answer five?



**8**

3. How many nought point fives are there in ten?

$$0.5 \times 2 = 1$$

$$1 \times 10 = 10$$

**20**

4. On average, the driest place on earth gets only nought point five millimetres of rain every year. In total, how much rain would it expect to get in twenty years?

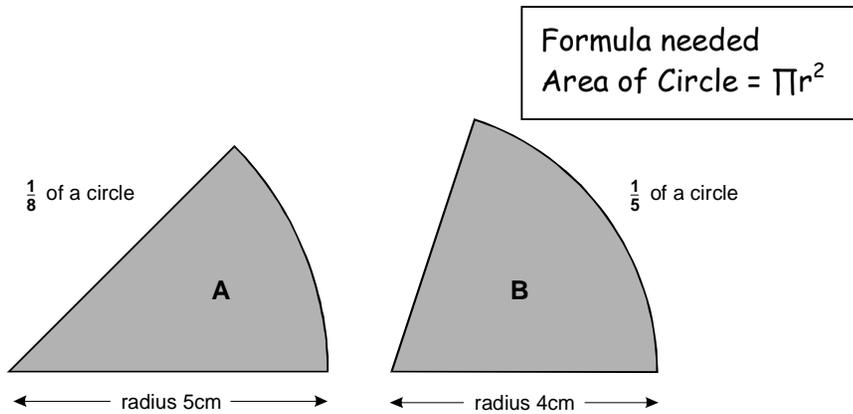
0

5. What is the sum of the angles in a rhombus?

All 4-sided shapes (quadrilaterals) have inside angles which sum to  $360^\circ$

## Which is bigger?

The diagram shows parts of two circles, sector A and sector B



- (a) Which sector has the bigger area?

Show working to explain your answer.

Area A =  $\frac{1}{8}$  of area of circle

$$= \frac{1}{8} \pi r^2$$

$$= \frac{1}{8} \times \pi \times 5^2$$

$$= 9.81748$$

$\therefore$  B has bigger area

$$B = \frac{1}{5} \pi r^2$$

$$= \frac{1}{5} \times \pi \times 4^2$$

$$= 10.053$$

**2 marks**

- (b) The perimeter of a sector is made from two straight lines and an arc.

Which sector has the bigger perimeter?

Show working to explain your answer.

**A**

$$\text{Circum} = \frac{1}{8} \times \pi \times d$$

$$= \frac{1}{8} \times \pi \times 10$$

$$= 3.92699$$

$$+ 2 \text{ straight lines } 2 \times 5 = 10$$

$$= 13.92699$$

**B**

$$\text{Circum} = \frac{1}{5} \times \pi \times d$$

$$= \frac{1}{5} \times \pi \times 8$$

$$= 5.02655$$

$$+ 2 \text{ straight lines } 2 \times 4 = 8$$

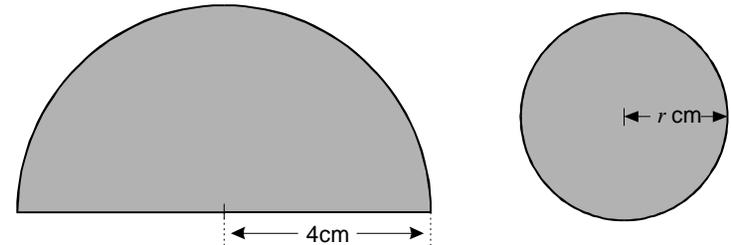
$$= 13.02655$$

**A has the bigger perimeter**

**2 marks**

- (c) A semi-circle, of radius 4cm, has the same area as a complete circle

Of radius  $r$  cm



What is the radius of the complete circle?

Show your working

$$\text{Semi-circle area} = \frac{1}{2} \pi r^2$$

$$= \frac{1}{2} \pi \times 16$$

$$= 8 \pi$$

Small Circle

$$8\pi = \pi r^2$$

$$r^2 = 8$$

$$R = \sqrt{8} = 2.829 \text{ cm}$$

**2 marks**

## Mental Questions

### KS3 MATHEMATICS

### 10 4 10

Level 8 Mental Arithmetic Questions

Answers

Day 10

1. It takes some-one one and a half minutes to swim the length of the pool. How many lengths can I swim in 15 minutes?

$$10 \times 1.5 = 15$$
$$\text{So } 15 \div 1.5 = 10$$

$$15 \div 1 \frac{1}{2}$$
$$= 15 \div 1.5$$
$$= \mathbf{10 \text{ lengths}}$$

2. Multiply minus eight by minus three.

$$-8 \times -3 = \mathbf{24}$$

$$8 \times 3 = 24$$
$$- 8 \times 3 = -24$$
$$8 \times -3 = -24$$
$$-8 \times -3 = 24$$

3. If  $4x + 3 = 23$ , what is the value of  $x$ ?

$$23 - 3 = 4x$$
$$20 = 4x$$
$$20 \div 4 = x$$
$$\mathbf{x = 6}$$

OR use matched line

4. I have a fair eight sided dice numbered 12 to 19. What is the probability that I will throw a prime number?

$$P(\text{prime number}) = \frac{3}{8}$$

Remember a prime number has only 2 factors, itself and 1.  
Possible primes are 13, 17 & 19.

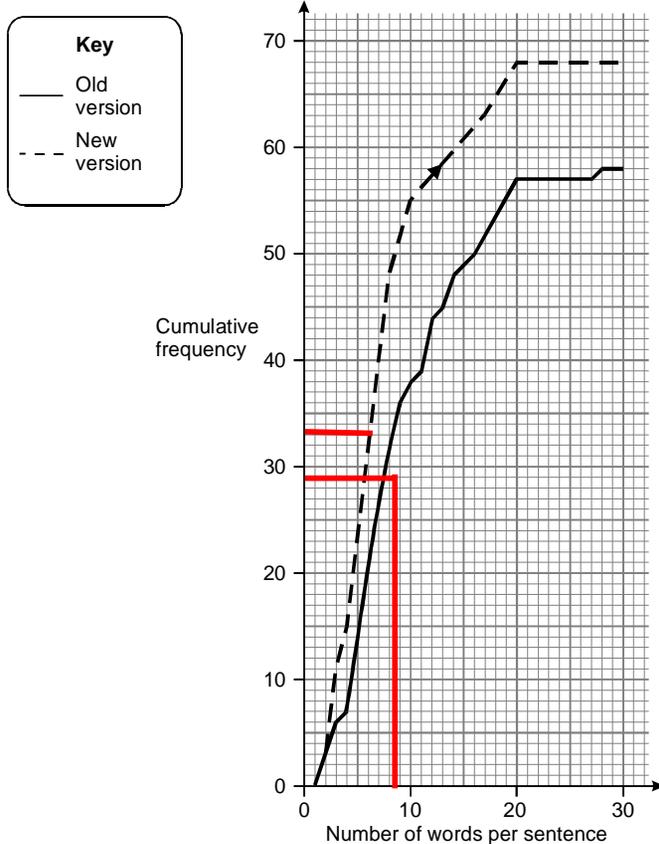
5. What must I multiply  $n$  squared by to get  $n$  cubed?

$$n^2 = n \times n$$
$$n^3 = n \times n \times n$$
$$\text{so } n^2 \times n = n^3$$

### Thomas the Tank Engine

The first 'Thomas the Tank Engine' stories were written in 1945.

In the 1980s, the stories were rewritten. The cumulative frequency graph shows the numbers of words per sentence for one of the stories.



There are **58 sentences** in the old version.

There are **68 sentences** in the new version.

3 marks

- (a) Estimate the median number of words per sentence in the old version and in the new version.

Show your method on the graph

old .....**7**.....  
 new .....**6**.....

3 marks

- (b) What can you tell from the data about the number of words per sentence in the old version and in the new version?



The old version has more words per sentence

1 mark

- (c) Estimate the percentage of sentences in the old version that had more than 12 words per sentence.

Show your working

Less than 12 words  $\frac{44}{58}$  more than  $\frac{14}{58}$

$$\frac{14}{58} \times 100 = 24.1\%$$

2 marks