



Mathematics Challenge 2014

25th January 2014

YEAR 7

Model Answers

We provide these model answers of our CWN: Mathematics Challenge 2014 exam to help parents.

Please note that for some problems there are more than one possible answer.

Some questions are open ended.

We strongly advise all children to practise the papers and think hard before looking at the answers provided.

Full answers and explanations will be provided on our feedback sessions.

In general, we expect units, directions, sensible answers and reasons in all questions.

Q1)

(a) Which of these fractions is nearest to 2?

Tick (✓) the correct answer.

$1 \frac{12}{23}$

$1 \frac{23}{34}$

$1 \frac{34}{45}$

$1 \frac{45}{56}$

$1 \frac{56}{67}$

(1 mark)

(b) Which set of fractions is ordered from least to greatest?

Tick (✓) the correct answer.

$\frac{1}{6} < \frac{1}{8} < \frac{1}{3}$

$\frac{1}{3} < \frac{1}{8} < \frac{1}{6}$

$\frac{1}{8} < \frac{1}{6} < \frac{1}{3}$

$\frac{1}{3} < \frac{1}{6} < \frac{1}{8}$

(1 mark)

(c) Kumar had $5 \frac{3}{4}$ cans of white paint.

He used $2 \frac{1}{6}$ cans of it while painting a room.

How much white paint does Kumar have left?

Answer: $3 \frac{7}{12}$

(1 mark)

(d) Brian had $7 \frac{1}{2}$ cans of white paint. He used a quarter of it while painting a room. How much does he have left?

Answer: $5 \frac{5}{8}$

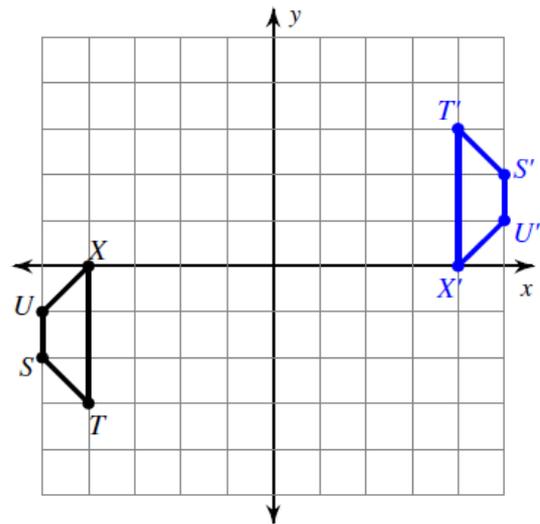
(1 mark)

Q2) How many different digits appear when $\frac{34}{111}$ is written as a recurring decimal?

Answer: 3

(1 mark)

Q3)



In the above diagram object $USTX$ has been transformed to $U'S'T'X'$.

Express fully the transformation from $USTX$ to $U'S'T'X'$.

Rotation about (0,0) through 180° clockwise (or anticlockwise)

Or any correct combined transformation:

For e.g.: y axis reflection followed by x axis reflection.

or rotation about X followed translation to the right by 8 units.

(1 mark)

Q4)

(a) Write 144 as a product of prime factors of using exponents.

$2^4 \times 3^2$

(1 mark)

(b) Kaveen bought the same amount of dog food and cat food last month, even though the dog food comes in 96-kilogram packages while the cat food is sold in 108-kilogram packages.

What is the minimum number of kilograms of each he must have bought?

864kg (1 mark)

Q5) A sequence starts at 1024 and is halved each time:

1024, 512, 256, ...

The sequence continues in the same way. Write the first two numbers in the sequence that are less than one.

$\frac{1}{2}$ and $\frac{1}{4}$ (1 mark)

After how many terms does the number become less than zero?

It will never become less than zero. (1 mark)

Q6) (a) 3 students are going on a field trip and 19 students are staying at school.

What is the **ratio** of the number of students who are staying at school to the total number of students?

Answer: 19 : 22 (1 mark)

(b) Which of these **ratios** are equivalent to 2 : 5 ?

Tick the correct answer(s). There may be more than one.

- | | | | |
|-------------------------------------|----------------|-------------------------------------|-----------------|
| <input type="checkbox"/> | $\frac{5}{10}$ | <input type="checkbox"/> | 5:2 |
| <input checked="" type="checkbox"/> | 1 : 2.5 | <input checked="" type="checkbox"/> | 40 % |
| <input type="checkbox"/> | $\frac{5}{2}$ | <input checked="" type="checkbox"/> | $\frac{18}{45}$ |

(1 mark)

Q7) Identify the **continuous** data in the following list.

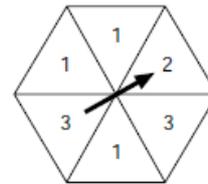
Tick the correct answer(s).

- Time taken to have dinner
- Height of a tree
- Shoe sizes
- Dates on a calendar
- Number of whole days estimated to complete a task

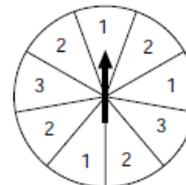
(1 mark)

Q8) Here you see five spinners:

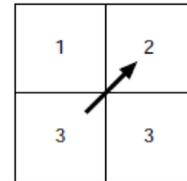
Spinner A - a regular hexagon with six sections



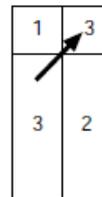
Spinner B - a circle with nine sections



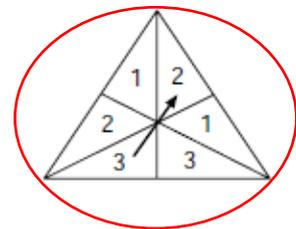
Spinner C - a square with four sections



Spinner D - a rectangle with four sections



Spinner E - an equilateral triangle with six sections

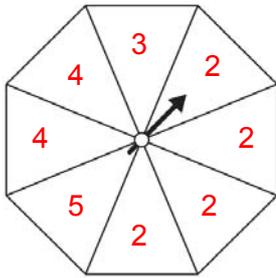


(a) Which of the spinner(s) are **fair**? Circle the spinner(s). There may be more than one.

(1 mark)

(b) Here is a spinner. It is a regular octagon.

One possible answer:

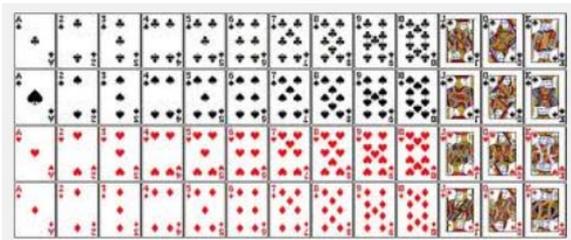
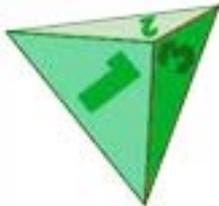


Write a number in each section of the spinner so that all of the following statements are true:

- It is **impossible** that you will get 1
- There is an **even chance** that you will get 2
- It is **less likely** that you will get 3 than 4
- It is **equally likely** that you will get 3 or 5

(1 mark)

(c) You roll a tetrahedron die and pick a playing card from a pack of 52 cards. How many possible **combined outcomes** are there?



Answer: $4 \times 52 = 208$ (1 mark)

(d) You roll a **normal** 6-sided die. What is the probability of not getting a 7?

Answer: 1 (1 mark)

Q9)

(a) Katherine picked up 7 cars on an early morning to conduct a survey on the different models of cars on Britain's roads. Does this constitute a **random sample**?

No (½ mark)

Why?

She did not pick cars at all times of the day. (½ mark)

(b) A local politician conducts an opinion survey on education from people who arrive for his meeting. Could this be **representative** of the town?

No (½ mark)

Why?

They surveyed only the people attending the meeting. This is not a representative sample of the town. (½ mark)

Q10) A passenger train and a freight train leave at 10:30 A.M. from stations that are 405 miles apart and travel toward each other. The speed of the passenger train is 45 miles per hour faster than that of the freight train. If they pass each other at 1:30 P.M., how fast was the passenger train traveling?

Show your working out.

Train	Average speed	Time taken	Distance travelled
Passenger	$x + 45$	3	$3x + 135$
Freight	x	3	$3x$

Both trains meet at the same point on the track. Therefore:

$$\begin{aligned} \text{Total distance travelled} &= \text{Length of track} \\ 3x + 135 + 3x &= 405 \\ x &= 45 \end{aligned}$$

Answer: 90 mph (2 marks)

Q11)

- (a) In May John bought a game for £100.

In June he sold it to Jenny for £200. In July he was sorry for selling the phone. So he bought it back from Jenny for £300. In August he lost interest in the game and wanted to focus on his homework, so he sold the game to a geek for £400.

Overall, what was the percentage profit John earned?

Show your working.

Total spent: £100 + £300 = £400

Gained: £200 + £400 = £600

Profit: £200

Percentage Profit: 50%

(1 mark)

- (b) John deposited £200 in his bank on a 5% annual simple interest. How much will he get back after 3 years?

Interest = £10 per year

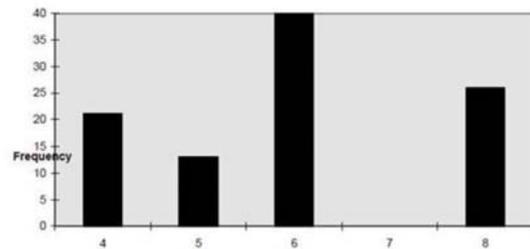
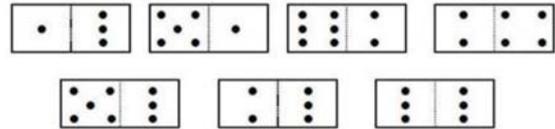
Total interest in 3 years = £30

Answer: £230

Accept £30 if the working is shown just for interest.

(1 mark)

Q12) Bernard has 7 dominoes in a bag. He takes out one domino and finds the total of the two numbers. He then **puts** the domino **back** in the bag. His 7 dominoes are shown below, together with a graph of his results after doing this experiment 100 times.



- (a) Explain why the total 7 never came up.

There are **no** dominos having a total of 7 dots on them.

(1 mark)

- (b) Explain why the total of 6 came up most often.

There are **more** dominos having a total of 6 dots than any other total.

(1 mark)

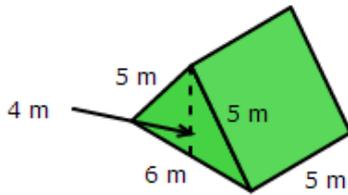
- (c) If Bernard repeats the experiment 100 more times how many times **will** he get 6 **and** why?

We **cannot be certain** because the dominos are picked at **random**.

(1 mark)

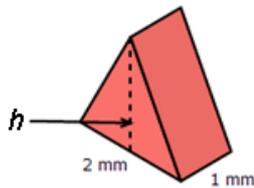
Q13)

(a) What is the **volume** of this prism?



60 cubic metres (1 mark)

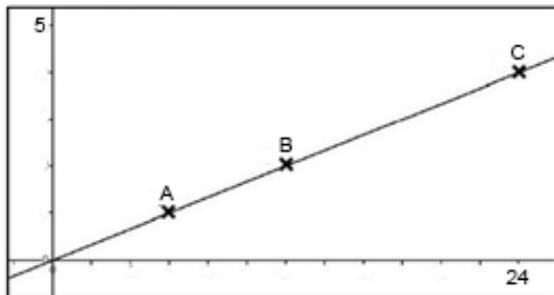
(b) In this prism calculate the area of the triangle facing you.



Volume = 2 cubic millimetres

Area = 2 mm² (1 mark)

Q14) Use the graph to answer the questions below. Scales are equally spaced on each axis.



The co-ordinates of A, B and C are:

A (6 , 1)

B (12 , 2)

C (24 , 4)

The value of D (not shown) also lies on this line (when extended).

(a) If D is (30 , a), what is the value of a?

a = 5 (1 mark)

(b) E is another point (not shown) on this line (when extended) and its coordinate is (b , 8).

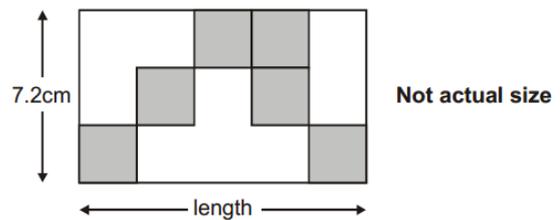
What is the value of b?

b = 48 (1 mark)

(c) If (p , q) is another point on this same line, write down a relationship (equation) between p and q.

p = 6q (1 mark)

Q15) Here is a rectangle with six **identical** shaded squares inside it.



The width of the rectangle is 7.2 centimetres.
Calculate the **area** of the rectangle.

Area: 86.4 cm²

(1 mark)

Q16)

(a) Which of the following fraction is closest to **quarter**?

$\frac{11}{40}$, $\frac{16}{60}$, $\frac{21}{80}$, $\frac{26}{100}$, $\frac{31}{120}$

Circle the correct answer.

(1 mark)

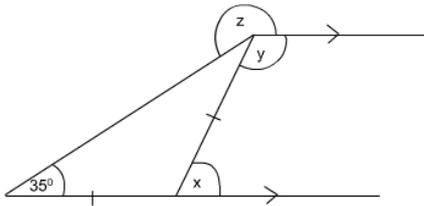
(b) Order the fractions starting with smallest.

$$\frac{5}{6} \quad \frac{7}{12} \quad \frac{2}{3} \quad \frac{5}{8}$$

$$\frac{7}{12}, \frac{5}{8}, \frac{2}{3}, \frac{5}{6}$$

(1 mark)

Q17) Work out the size of each angle using the standard geometric clues to indicate equal sides and parallel lines.



$$x = 70^\circ \quad y = 110^\circ \quad z = 215^\circ$$

(1 mark)

Q18)

(a) One of the statements about Highest Common Factor (HCF), Least Common Multiple (LCM), Product of two numbers is true.

Circle the correct statement.

- HCF x LCM = Product
- HCF + LCM = Product
- LCM - HCF = Product
- HCF - LCM = Product
- LCM ÷ HCF = Product

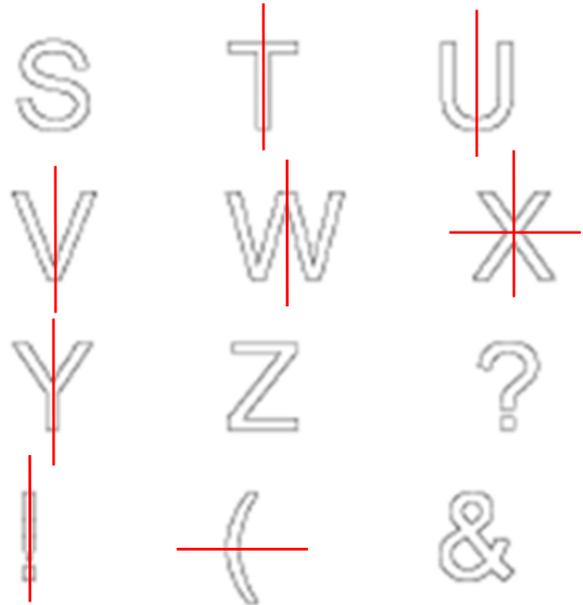
(1 mark)

(b) One of the above names is another name for the greatest common divisor. Which is it?

Highest Common Factor (HCF)

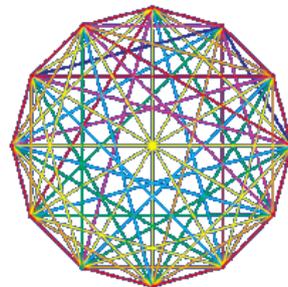
(1 mark)

Q19) Draw line(s) of symmetry (if there are any) in each shape using a ruler.



(2 marks)

Q20) The picture below is called a 12-point mystic rose. Each point in the circle is connected to the other 11 points on the circumference by a line.



(a) How many lines are there?

66 (1 mark)

(b) Imagine these 12 points as world leaders meeting on a conference and the lines as handshakes. If 3 leaders fail to attend the conference how many handshakes would have been made?

36 (1 mark)

Q21) Solve for x :

(a)

$$5(2 - x) - 3(4 - 2x) = 20$$

$$10 - 5x - 12 + 6x = 20$$

$$-2 + x = 20$$

$$x = 22$$

(1 mark)

(b)

$$\frac{x}{5} + \frac{x}{3} = 10$$

$$3x + 5x = 150$$

$$8x = 150$$

$$x = \frac{75}{4} \text{ or } 18\frac{3}{4}$$

(1 mark)

Q22) Which of the following statements are true when m and n are directly proportional?

Tick the correct statement(s).

- When m increases by 10, n also increases by 10.
- When m increases by 10 times, n also increases by 10 times.
- When m decreases by 10 times, n also decreases by 10 times.
- When m decreases by 10 times, n increases by 10 times.
- The ratio of $m : n$ is constant.

(1 mark)

Q23)

(a) Which has the greater mass, 3 kg of onions or 7 lb of bird feathers?

7 lb (1 mark)

(b) A bucket holds 5 litres of water.

250 ml of water is drained from the bucket every minute.

How many minutes will it take for the bucket to be empty?

20 minutes (1 mark)

Q24)

(a) In a car park on a Wednesday the ratio of cars : vans is 5 : 8.

If there are 40 vans, how many vehicles are there altogether?

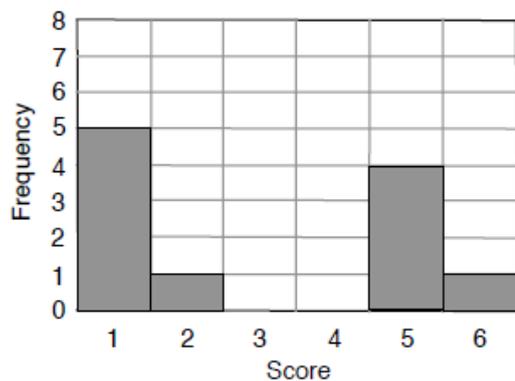
65 (1 mark)

(b) The next day the number of cars doubled and vans halved.

How many vehicles are there on that Thursday?

70 (1 mark)

Q25) Using this frequency chart work out the mean, median, mode and range.



Mean score	3
Median score	2
Mode score	1
Range of scores	5

(2 marks)