Mathematics Challenge 2015

by

Children's Well-wishers Network (CWN)

YEAR 8

45 minutes

Do **NOT** open this booklet until instructed

Calculators must **NOT** be used

- Write your **name** and **candidate number** in the spaces provided at the top of the page.

- You have 45 minutes for this paper which is worth 50 marks.

- Write your answers in pencil. Do NOT use a pen.

- Answer all 25 questions, attempting them in order and writing your answers clearly.

- If you find that you cannot answer a question straight away leave it blank and move on to the next question. Return to it later if you have time.

- Wherever applicable answers should carry units.

- Scrap paper is available on request.

| For Examiner's use only ||
Question No.	Score
Q1	/ 3
Q2	/ 3
Q3	/ 1
Q4	/ 1.5
Q5	/ 1
Q6	/ 3
Q7	/ 1
Q8	/ 3
Q9	/ 2
Q10	/ 2
Q11	/ 2
Q12	/ 2
Q13	/ 1
Q14	/ 3
Q15	/ 2
Q16	/ 1
Q17	/ 2
Q18	/ 2
Q19	/ 2
Q20	/ 3
Q21	/ 2
Q22	/ 1
Q23	/ 1
Q24	/ 3
Q25	/ 2.5
Total	/ 50

Q1) A regular polygon is shown below. Workout the unknown angles *a*, *b* and *c*.
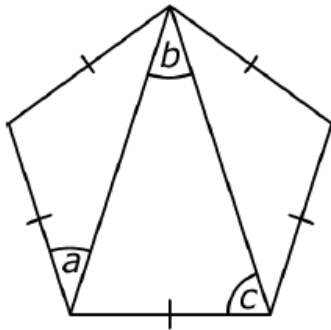
a = _____ ° **(1 mark)**

b = _____ ° **(1 mark)**

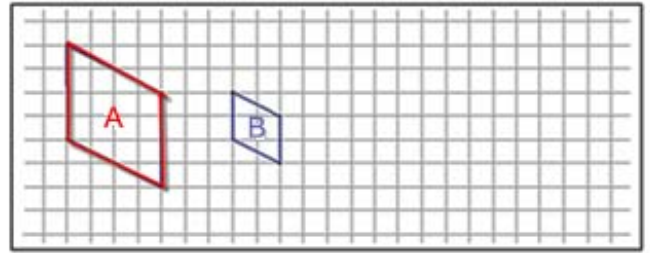c = _____ ° **(1 mark)**

Q2)

(a) Find the centre of this 90 degree rotation:
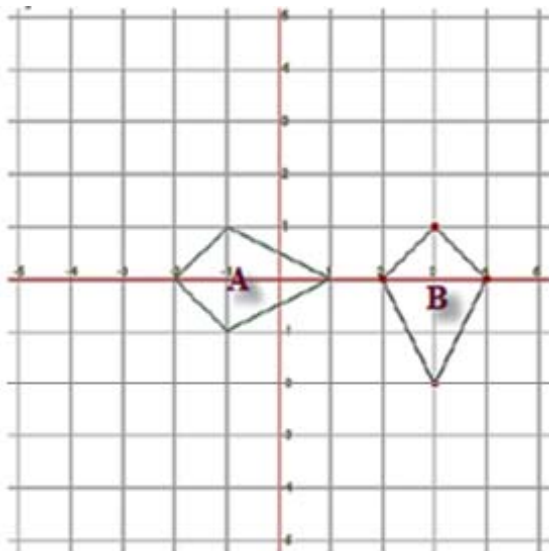
(1 mark)

(b) Show the centre of enlargement **from** A to B in the grid.

(1 mark)

(c) In the above transformation the linear scale factor is:

_____

(1 mark)

Q3)

(a) CWN News headline was:

"Interest Rates Jump From 10% to 12%"

This means the rise is 2 percentage points. What was the real percentage increase?

_____

(½ mark)

(b) A store purchased a fountain for £100 and marked it up by 200%. Joseph makes a 12% commission on all of his sales. How much commission did he make when he sold the fountain?

_____

_____

(½ mark)

7

Q4) A normal six-sided dice is thrown 600 times. It lands 150 times on 4.

(a) What is the relative frequency of the dice landing on 4?

_____

(½ mark)

(b) Is this dice biased?
Explain your answer.

_____

_____

(1 mark)

Q5) The marked price of a computer set is £1500. It can be purchased using either one of the schemes below:

- **Cash Scheme:** 15% Discount

- **Hire Purchase Scheme:** Down payment: 10 % and then Monthly £100 only for 24 months
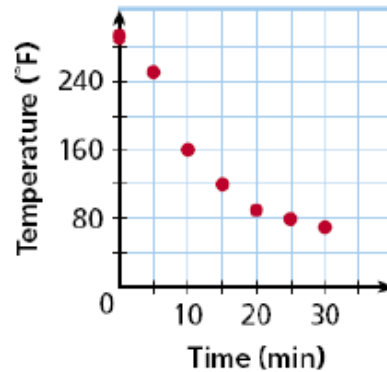
Find the difference between the Hire Purchase price and the cash price.

Answer: _____

(1 mark)

Q6) There are 3 scatter plots below that represent the relationship between the number of minutes since a pie has been taken out of the oven and the temperature of the pie.
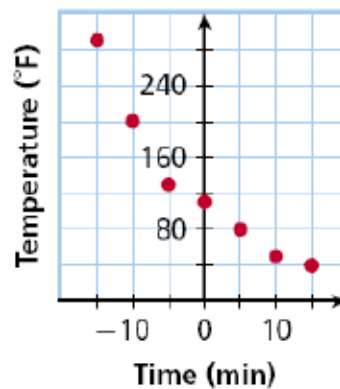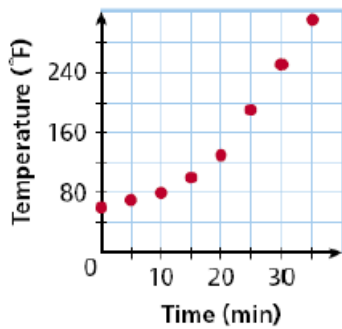Explain each relationship indicating sensibility:

(a)

_____

_____

(1 mark)

(b)

_____

_____

(1 mark)

$4\frac{1}{2}$

(c)

_____

_____

(1 mark)

Q7) Below is Kamala's work solving an equation.

Original equation:
$$2x + 2(x - 1) = 4(x - 3) + 10$$
Expand:
$$2x + 2x - 2 = 4x - 12 + 10$$
Combine like terms:
$$4x - 2 = 4x - 2$$
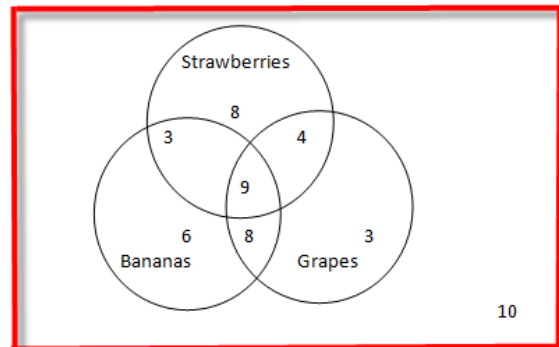_Add 2 to both sides:_
$$4x = 4x$$
Subtract 4x from both sides:
$$0 = 0$$

Kamala says: "There is no solution."
Is she correct?   Explain.

_____

_____

_____

(1 mark)

Q8)   The Venn diagram below shows the favourite fruits of a Year 8 class.

i.   How many children didn't like any of these fruits?

_____   **(½ mark)**

ii. How many children liked only bananas?

_____   **(½ mark)**

iii. How many children liked bananas and strawberries?

_____   **(½ mark)**

iv. How many children liked strawberries and grapes?

_____   **(½ mark)**

v.   How many children liked only bananas and grapes?

_____   **(½ mark)**

vi. How many children liked mangoes?

_____   **(½ mark)**
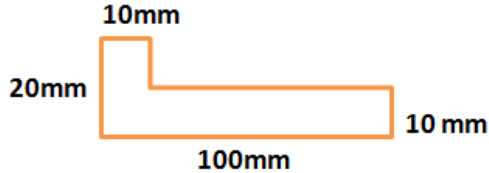
Q9)

(a) Solve fully for t:

$$3 - 2t > 8$$

_____

_____
(1 mark)

(b) Solve for the real number r:

$$4r^2 = -9$$

_____

_____
(1 mark)

Q10)

10mm

20mm

10 mm

100mm

The diagram shows the plan of a field.
The scale ratio is 1 : 1000
All angles are right angles.
What is the area of the field in hectares?

_____

_____

_____

_____
(2 marks)

Q11)

(a) Write these numbers in **descending** order:

| 0^{20} | $(-2)^5$ | 1^{30} | $\left(\dfrac{1}{4}\right)^3$ | 0.2^3 |

_____ , _____ , _____ , _____ , _____
(1 mark)

(b) Write these numbers in **ascending** order:

| $\sqrt{2}$ | π | 10^{-1} | $\dfrac{1}{2}$ | 0.3 |

_____ , _____ , _____ , _____ , _____
(1 mark)

Q12) Find the volume of hut below if the model was built with the linear scale factor 1: 10.

2.3 m

130 cm

8.4 m
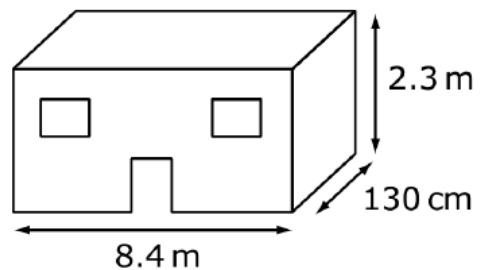
Volume in cm^3 : _____

Volume in m^3 : _____
(2 marks)

Q13)   The scores for three consecutive tests undertaken by a Year 8 group are presented in the table below:

	Test 1 (score out of 20)	Test 2 (score out of 50)	Test 3 (score out of 100)
Lowest score	5	12	20
Highest score	19	43	75
Lower quartile	9	19	35
Upper quartile	15	35	70

Which of the following statements are true?

1.   The highest and lowest scores for the year group declined over the three tests.

2.   There was no change in the year group's performance over the three tests.

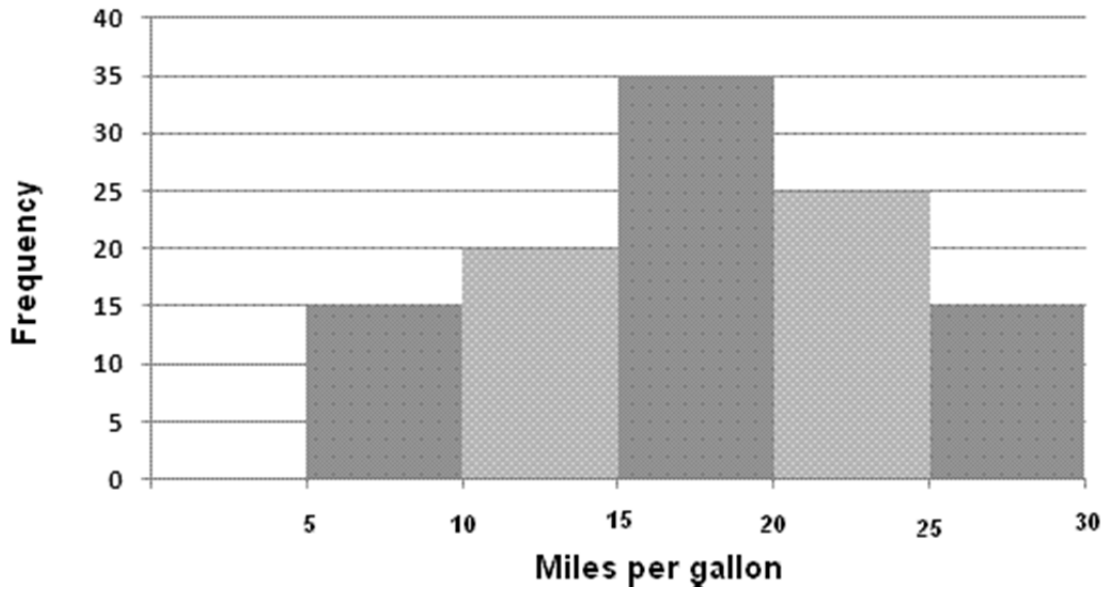3.   The scores for the year group improved over the three tests.

Answer: _____   **(½ mark)**

Give your reason(s).

_____

_____

_____

                                                              (½ mark)

Q14)

The histogram above shows the efficiency level (in miles per gallons) of 110 cars.

(a) What is the mean efficiency to the nearest miles per gallon?

_____

(1 mark)

(b) How many cars have an efficiency of more than 20 miles per gallon?

_____

(½ mark)

(c) How many cars have an efficiency of 4 miles per gallon?
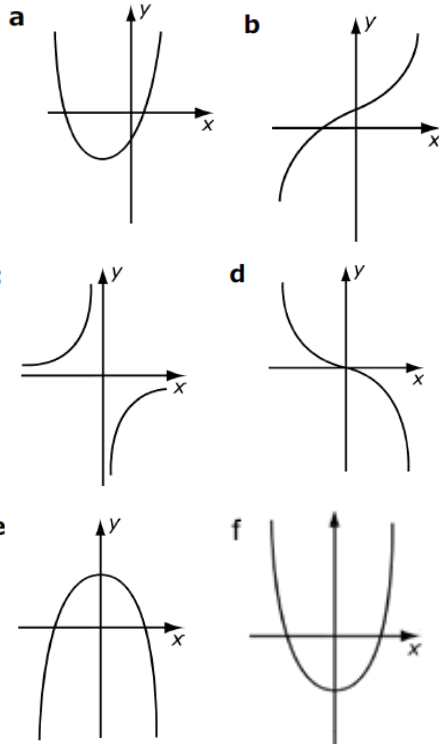
_____

(½ mark)

(d) How many cars have an efficiency of 7 miles per gallon?

_____

(½ mark)

(e) What percentage of cars has efficiency less than 20 miles per gallon?

_____

(½ mark)

3

Q15) Match the equations with the graphs by writing the appropriate letter next to it.

a   **b**

c   **d**

e   **f**

$y = x^3 + 4$ _____

$y = x^2 - 5$ _____

$y = \dfrac{-1}{x}$ _____

$y = -x^3$ _____

$y = x^2 + 2x - 3$ _____

$y = 5 - x^2$ _____

(2 marks)
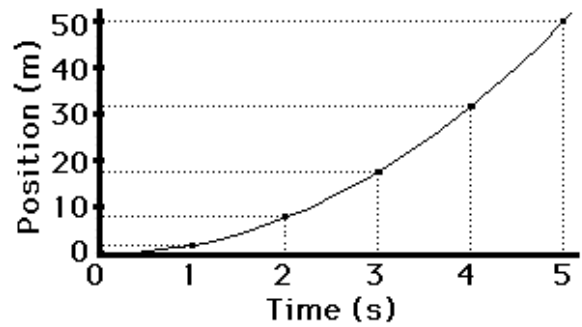
Q16) Add 7×10^{-70} and 4×10^{-69}.

Write the answer in standard form.

_____

_____

_____

(1 mark)

Q17)

(a) In the above graph how does the position vary with time?

_____

_____

(1 mark)

(b) Workout the average velocity between the 4th and 5th second.

_____

_____

(1 mark)

5

Q18) You spun this biased spinner 100 times.
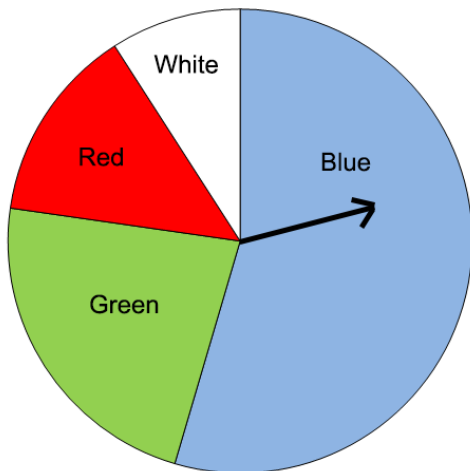
(a) Record a possible result of your experiment in the table below.

Color	Frequency
Blue	
Green	
Red	
White	

(1 mark)

(b) As per your experiment, what is the probability of the spinner landing on Red?

Give your answer as a fraction.

_____

(1 mark)

Q19) **Bias** is a term which refers to *how far* the average statistic lies from the parameter it is estimating, that is, the error which arises when estimating a quantity.

Precision is a measure of *how close* an estimator is expected to be to the true value of a parameter.

The following illustrates bias and precision, where the target value is the bullseye:
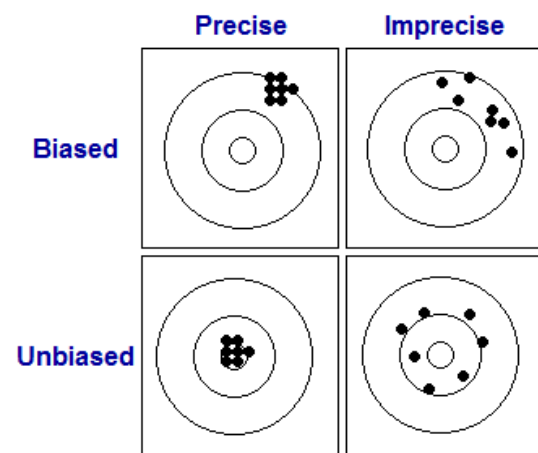
The police decided to estimate the average speed of drivers using the fast lane of the motorway and considered how it could be done.

(a) One method suggested was to tail cars using police patrol cars and record their speeds as being the same as that of the police car. This was likely to produce a biased result. Why?

_____

_____

_____

(1 mark)

(b)   The police then decided to use an unmarked car for their investigation using a speed gun operated by a constable. This was an unbiased method of measuring speed, but was imprecise compared to the above method. Why?

_____

_____

_____
(1 mark)

Q20)

(a)   Peter deposits £1000 in a savings account. The savings account accrues **compound** interest at a flat rate of 10% per annum.
       If the interest is calculated at end of year, how much will the account be worth in 2 years?

_____

_____

_____
(1 mark)

(b)   He withdraws £100 at the beginning of second year how much will be in the account after 2 years?

_____

_____
(1 mark)

(c)   John buys £2500 of shares. He receives an annual dividend of 5% of his investment as cash into his current account.
He wants to go on a holiday using only the cash that he has received in this manner. He estimates the holiday will cost £350. Assuming that he does not receive interest on his current account, after how long will he be able to afford his holiday?

_____
(1 mark)

Q21)   x and y are two different integers taken from 1 to 100.

(a)   What is the largest value that $\dfrac{x+y}{x-y}$ can have?

_____
(1 mark)

(b)   What is the largest value that $\dfrac{x-y}{x+y}$ can have?

_____
(1 mark)

Q22)   In this question x, y, z are lengths. Circle the expressions that could represent area among the following formulae.
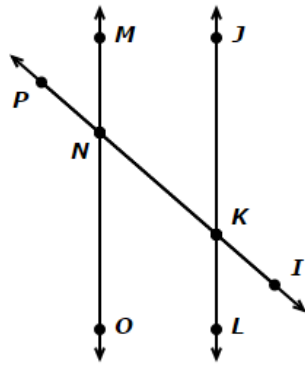
$$\pi x\sqrt{y^2 + z^2}$$ $$\pi(x+y)z$$

$$\frac{5(x+y)}{z}$$ $$\frac{3xyz}{(x+y+z)}$$

(1 mark)

Q23) $\overleftrightarrow{JL}$ and $\overrightarrow{MO}$ are parallel lines.
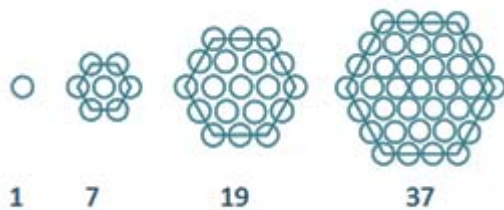

Which are adjacent angles?
Tick the correct answer(s).

☐ $\angle MNK$ and $\angle ONK$

☐ $\angle MNK$ and $\angle JKI$

☐ $\angle MNK$ and $\angle ONP$

☐ $\angle MNK$ and $\angle LKN$

(1 mark)

Q24)

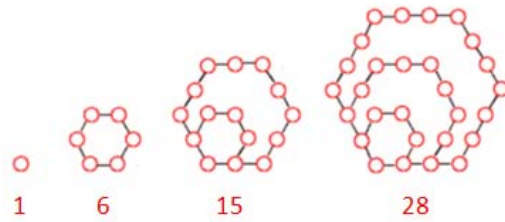**(a)** Hexagonal-centred numbers are found as follows.

1   7   19   37

Write the next three hexagonal-centred numbers.

_____ , _____ , _____.

(1 mark)

(b) Hexagonal numbers are found as follows.

1   6   15   28

Write the next two hexagonal numbers.

_____ , _____ .

(1 mark)

(c) Find the first three terms of the sequence defined below, where n represents the position of a term in the sequence. Start with n = 1.

$$2(3)^n - n$$

_____ , _____ , _____ .

(1 mark)

Q25)

(a) Calculate:

$((1-1) - 1 \text{x} 2) - (1 - (1-1) \text{x} 2)$

_____

_____

_____

(½ mark)

$\overline{4\frac{1}{2}}$

(b)   Work out : $4 \times 6 + 18 \div 2$

_____

_____

(½ mark)

(c)   Calculate: $x^2 - 3x$ where $x = {}^-2$

_____

_____

(½ mark)

(d)   Solve $| 2n - 3 | < 6$ where n is an
         integer.   Write all possible solutions.

_____

_____

_____

_____

_____

(1 mark)

$\overline{2}$