



Mathematics Challenge 2015

by

Children's Well-wishers Network (CWN)

YEAR 7

Mark Scheme

We provide mark schemes of our CWN Mathematics Challenge 2015 examination papers 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.

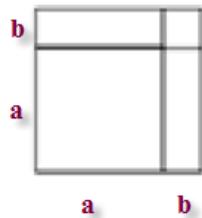
Q1) Express $(a + b)^2$ in four different ways using these diagrams.

where:

a represents the small part of the length,
b represents the larger part of the length

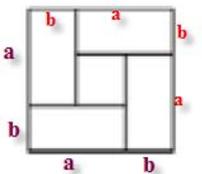
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- $(a + b)^2 = a^2 + ab + ab + b^2$



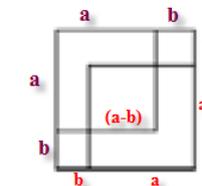
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- $(a + b)^2 = (a - b)^2 + 4ab$



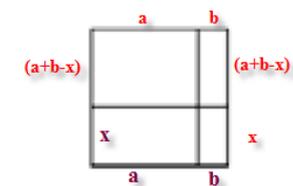
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- $(a + b)^2 = 2a^2 + 2b^2 - (a - b)^2$



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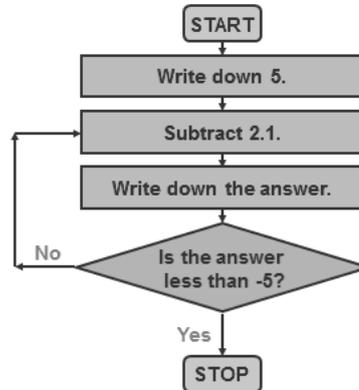
- $(a + b)^2 = ax + a(a + b - x) + b(a + b - x) + bx$



(2 marks)

Q2)

(a) Generate a sequence using the instructions:



5, 2.9, 0.8, -1.3, -3.4, -5.5

(1 mark)

(b) In this generation we get a finite sequence. How can we change the instructions so that it would generate a new infinite sequence?

Many possible answers.

Change needed:

e.g. Change the question to:
 "Is the answer greater than 5?"

(1 mark)

(c) Complete the position-to-term rule to express the new generation.

$n \rightarrow 7.1 - 2.1n$

(1 mark)

(d) Write the two simultaneous rules (initiation and term-to-term) to express the new generation.

Initiation Rule: $u_1 = 5$

Term-to-term Rule 2:

$u_{n+1} = u_n - 2.1$

(2 marks)

Q3) Ram made a deposit of £ x in a bank. The bank gives him 2 % annual interest. He doesn't want to withdraw any money.

(a) What would be the expression for working out the account balance after a year of deposit?

Write it as a **product**.

£ 1.02 x

(1 mark)

(b) What would be the expression for working out the account balance after two years of deposit?

Write it using **power notation**.

£ 1.02² x

(1 mark)

(c) What would be the expression for working out the account balance after n years of deposit?

Express it in **power notation**.

£ 1.02 ^{n} x

(1 mark)

Q4)

(a) If you have to cut a piece of string into 14 equal pieces, and each cut takes 1 second, how long should the whole job take?

13 seconds

(1 mark)

(b) If 6 cats can catch 6 rats in 6 minutes, how many cats are needed to catch 10 rats in 10 minutes?

(You may assume the rate of rats killed per minute by one cat is constant.)

6 cats

(1 mark)

Q5) Look at the conversation below between John and Bill.

John says:
"But isn't it the case that 50 per cent of your committee members are ready to accept this proposal now?"

Bill says:
"That's not the case at all - quite the reverse in fact."

Explain what is wrong with Bill's statement.

Reversal (not ready to accept) is too 50%

Reversal means "a change to an opposite direction, position, or **course of action**"

(1 mark)

Q6) Numeral means a symbol or group of symbols used to express a number, for example: 6 (Arabic), VI (Roman), and 110 (binary).

Express 49 in Roman numerals.

XLIX

(1 mark)

Q7) Which of these two events are mutually exclusive? Cross out the inappropriate answer.

Picking one card from a standard deck and:

i. choosing an ace or a king

Answer: ~~Mutually exclusive~~
Not mutually exclusive

(½ mark)

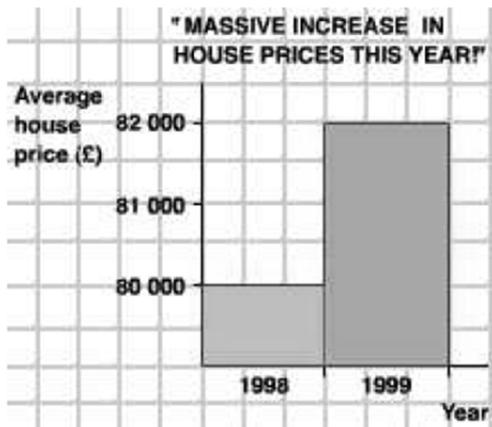
ii. choosing a red card or a king

Answer: ~~Mutually exclusive~~
Not mutually exclusive

(½ mark)

Q8)

(a) Why does the bar chart below mislead?



There is no zero (origin). Average house price starts at £79 000.

(1 mark)

(b) What is wrong or missing on the graph below?



Give two answers.

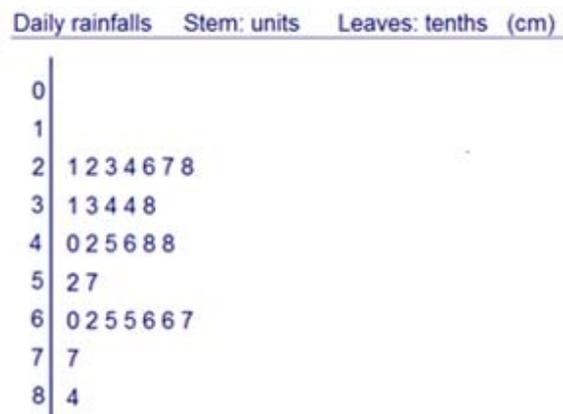
- No variables indicated in the axes.
- Vertical scale is not scaled linearly.

Accept also:

- Title is missing.

(1 mark)

Q9) A stem-and-leaf diagram of daily rainfalls of a month is shown below.



(a) Which month could it be?

February.

(½ mark)

(b) What is the range of rainfall?

6.3 cm

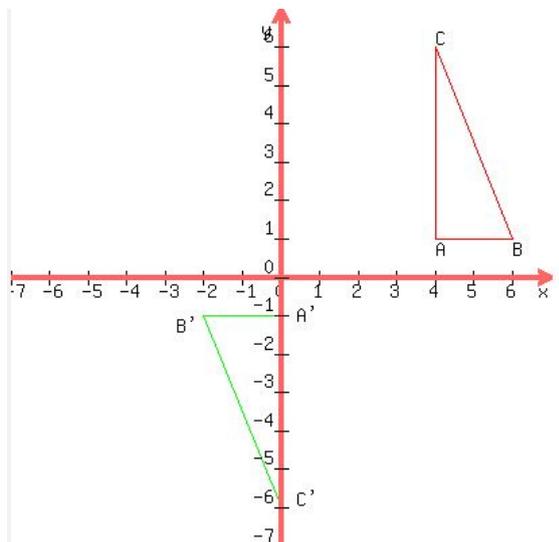
(½ mark)

(c) What is the median rainfall?

4.5 cm

(½ mark)

Q10) Describe fully the single transformation from shape ABC to shape A'B'C'.



Rotation of 180° about (2,0)
(clockwise/anti-clockwise)

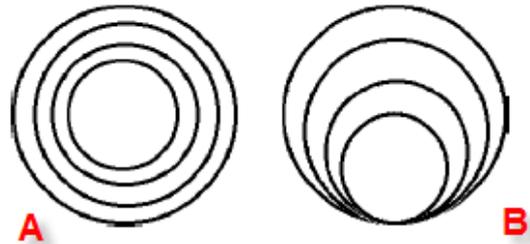
(1 mark)

Q11) The value of a £400,000 flat increased by 10% in June. Its new value increased by a further 10% in October. What was its value in November?

£400 000 x 1.1 x 1.1
= £484,000

(1 mark)

Q12) Which picture contains more white space?



Answer: Neither or "we cannot tell"; both have same amount of white space.

(½ mark)

Explain your reason(s).

Thinking two circles one of the top cover the bottom, it doesn't matter wherever it is the uncovered area is same.

(½ mark)

Q13)

(a) Show that 4,938,449,472 is divisible by 792.

$$792 = 8 \times 9 \times 11$$

$$4,938,449,472 = 8 \times 9 \times 11 \times 6235416$$

Using reductions by 8,9,11 or by long division it could be proved.

(1 mark)

(b) Relate composite numbers with prime numbers.

Composite numbers are NOT primes.

(1 mark)

(c) Do you accept that 1 is not a prime number? Why?

Yes

It does not fit the definition of prime: Prime numbers are the +ve whole numbers that have exactly two factors.

(1 mark)

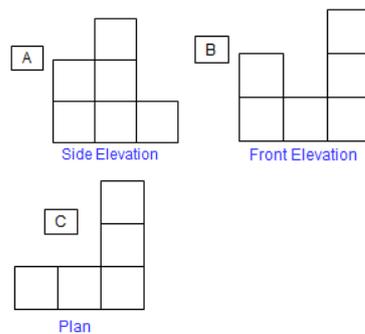
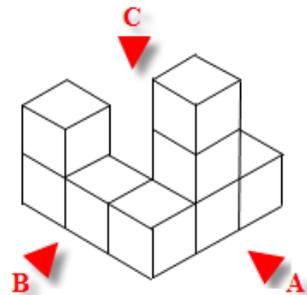
(d) 8, 9, 11 are pairwise coprime. Why?

$$\text{HCF}(8,9) = \text{HCF}(9,11) = \text{HCF}(8,11) = 1$$

(1 mark)

Q14) Draw the plan, front and right side elevations of the object shown below.

(You need indicate plan, front, and side view below)



Award ½ mark for one or two correct views.

Award 1 mark for all three correct views.

(1 mark)

Q15)

(a) A DVD costs £20. What will happen if the price increases by 50%?

Many possible interesting answers:

- Price will increase to £30
- Sales will become down
- Customers will switch to another type of TV
- Who sell a TV for £20?

(½ mark)

(b) By what percentage does this new price need to decrease to return to the original price £20?

$$33\frac{1}{3}\%$$

(1 mark)

(c) Will your answer to (b) work for all initial prices, i.e. not only for £20?

Yes.

(½ mark)

Why? Explain.

$$x \times 150\% \times 66\frac{2}{3}\% = x$$

$$100\% - 66\frac{2}{3}\% = 33\frac{1}{3}\%$$

(½ mark)

Q16) Raman planned to make cakes with cream as follows.

Number Cakes	3	6	9	12	15
Cream (grams)	1.5	3	4	6	7.5

Seetha said the relationship shown above is not proportional.

Raman looked up again and changed an amount of cream in his plan to make the figures were proportional.

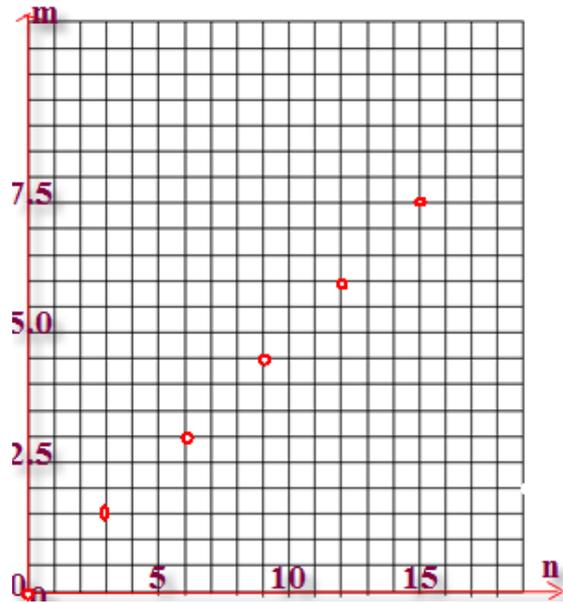
(a) Which value did he change and what was the new value?

Number Cakes	3	6	9	12	15
Cream (grams)	1.5	3	4.5	6	7.5

4 (g) was changed to 4.5 (g)

(½ mark)

(b) Show the relationship between number of cakes and amount of cream in the grid follows:



Award ½ mark for connected (line) graph.
Award 1 mark bar graph with correct heights.

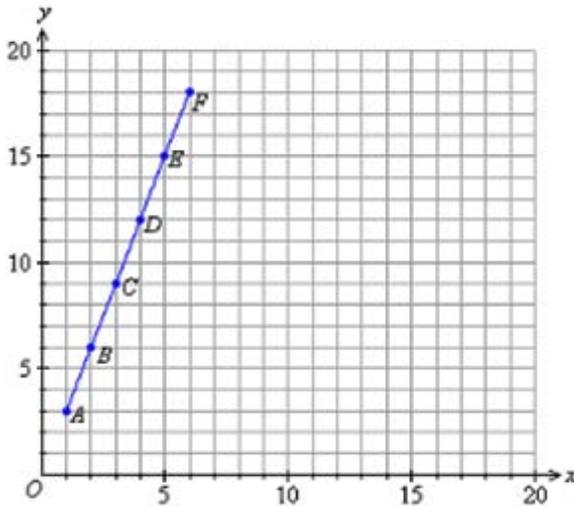
(1 mark)

(c) Show the relationship as a discrete equation using:
n for number of cakes,
m for the amount of cream.

$$m = \frac{1}{2} n \quad [\text{where } n \in \mathbb{N}]$$

(1 mark)

Q17) Use the following graph answer the questions below.



(a) Does this graph show a proportional relationship?

Yes

(½ mark)

Explain your answer.

The straight line (¼ mark)

passes through origin (0, 0) when extended (¼ mark)

(½ mark)

(b) What is the equation of the line?

$$y = 3x$$

(½ mark)

Q18)

(a) There are 250 children and some teachers going on a theatre trip. They need to travel from the school to the theatre in vans. The accompanying teachers and the driver have their own seats. Each van can carry 6 children. How many vans will be needed?

42 (vans)

(½ mark)

(b) I have saved £1500 to buy an annual travelcard that costs £1400.

A single day anytime travelcard for unlimited travel costs £5.

I work on all weekdays 52 weeks a year, including public holidays.

(i) Can I afford an annual travelcard? Justify your answer.

Yes, £1500 is greater than £1400.

Award ½ mark only if correct justification is provided.

(½ mark)

(ii) Is it advisable to buy an annual travelcard? Give your reason(s).

E.g.1: (Assumption based)

Yes, if you work all days and use travelcard in weekends as well to travel. To get the value: (£1400 / £ 5 = 280 days Without weekends: 52 x 5 = 260 days roughly

With all weekends: 365 days (Assumption must be clear)

E.g.2: (Non-assumption based)

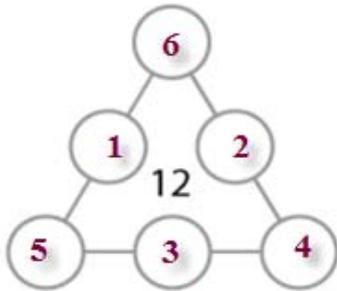
We cannot advise. Information provided is NOT SUFFICIENT. As we do not know whether he travels at weekends we cannot tell whether it will be cheaper.

Award ½ mark only if valid reasoning is provided.

(½ mark)

Q19) Complete the triangle below using the following constraints:

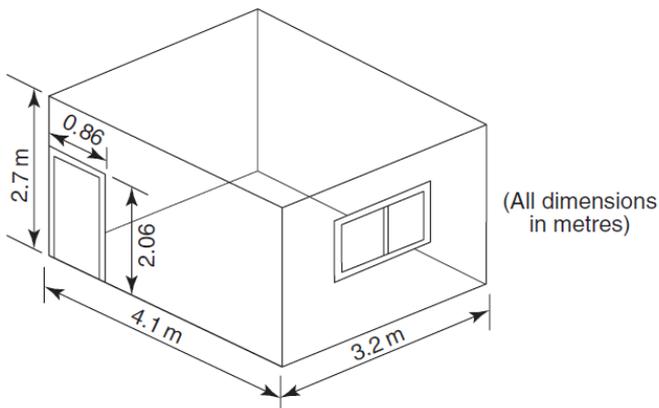
- When you add the numbers on each side of the triangle you should get the middle number 12.
- You can only use the integers from 1 up to 6.



Accept any valid answer.

(1 mark)

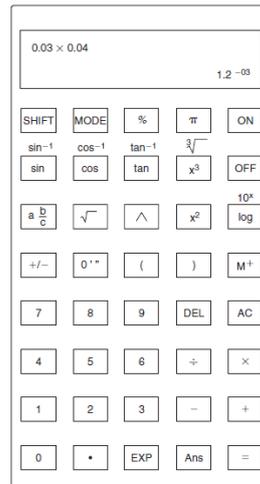
Q20) Calculate the length of skirting board required for the room below:



$$(4.1 + 3.2 - 0.86) \text{ m} + 4.1 \text{ m} + 3.2 \text{ m} = 13.74 \text{ m}$$

(1 mark)

Q21)



(a) Does this calculator show the correct answer to 0.03×0.04 as 1.2×10^{-03} ?

Yes

(½ mark)

(b) Which buttons would you press to enter 1.2×10^{-3} in the calculator?

Either:

- Press 1 , Press . (decimal point), Press 2
- Press EXP
- Press +/-
- Press 3

Or:

- Press 1, Press . (decimal point), Press 2
- Press Multiplication operation sign
- Press 1, Press 0



- Press power sign
- Press 3
- Press +/-

Or:

- Press 1, Press . (decimal point), Press 2,
- Press Multiplication operation sign
- Press Shift, Press log button,
- Press minus sign
- Press 3

(1 mark)

- (c) Convert the answer shown on the calculator to decimals.

0.0012

(½ mark)

- (d) In what mode is the calculator set now?

Scientific

(½ mark)

Q22) During one evening after school Thevi devoted two-fifths of her time to Volleyball, three-twentieths of her time on worshipping gods, a third of her time having dinner and taking a bath, and the remaining 42 minutes chatting on her mobile phone. Afterwards she goes straight to bed.

- (a) How much time did she spend on studying Mathematics?

0 minutes

(½ mark)

- (b) If she comes back from school by 3p.m. What time did she go to bed?

9 p.m.

(2 marks)

Q23) The following bar graph is the result of an honest poll conducted on parents to find how their children spend their time, in a town called Mundaasuppaddi, using a local postal questionnaire.

Schooling	■	■	■	■	■	■	■	■	■
Playing Football and other games	■	■	■	■	■	■	■	■	■
Chatting with friends	■	■	■	■	■	■	■	■	■
Attending Social get-togethers	■	■	■	■	■	■	■	■	■
Spending time on religious functions	■	■	■	■	■	■	■	■	■
Helping parents	■	■	■	■	■	■	■	■	■
Doing Home work	■	■	■	■	■	■	■	■	■

- (a) What was the probability that the children are keen in doing homework assuming the whole population of Mundaasuppaddi gave an answer to the poll?

0

(½ mark)

- (b) Give a reason why most polls conducted are biased.

Many possible answers.

E.g.: It is impractical to get the response from whole population, especially within a time frame.

(1 mark)

- (c) What was wrong with the above poll? Give two answers.

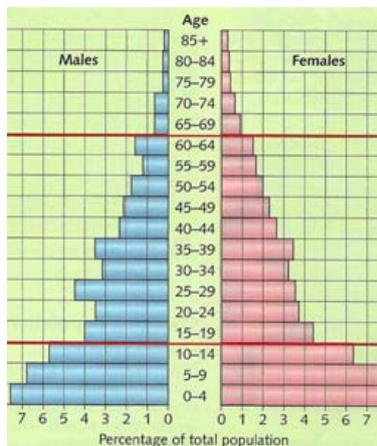
Many possible answers. Sensible answers within the context is acceptable.

1. It doesn't cater all options of children.
2. There is no key to indicate the number of children
3. There is no guarantee the questionnaire and/or response reaches all parents.

(2 marks)

Q24) The following diagram is the population pyramid of a country. Using this evidence:

- Insert tick (✓) for the correct statements in the box.
- If an answer cannot be predicted insert a question mark (?) in the box.
- Insert a cross (X) for the incorrect statements in the box.
- Leave blank if you could not attempt the question.



- ? There are few older people who are elderly dependents.
- A narrow top on the pyramid means a short life expectancy.
- ? A few people in 30-65 age groups are economically active.
- Narrowing pyramid shapes show decreasing numbers in each group.
- A wide base indicates high death rate.
- A high proportion of people are below 15.

(3 marks)

Q25)

(a) Which circle is bigger: a circle with an area of π square units or one with a circumference of π units? Give your reason(s).

The radius of the circle that has circumference π units has the radius $\frac{1}{2}$ units and area $\frac{1}{4} \pi$ square units.

The other circle that has an area of π square units is therefore bigger.

(1 mark)

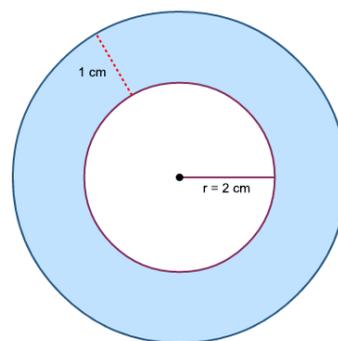
(b) Which grows faster: the area of a circle or its circumference, assuming the radius is greater than 2?

Area of the circle grow faster for radius greater than 2

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

(c) Both circles below have the same centre. What is the area of the shaded region?

Express your answer as a multiple of π .



Answer: 5π .

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