



EP.M88 Multi-Step Reasoning Challenge Set 3

GL ASSESSMENT GL-11PLUS-MATHS · Calculators not allowed · about 75 minutes

Total Marks

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Name: _____ Date: ____ / ____ / ____

Answer ALL questions. Show all your working.

- 1** Ravi is 8 years old. His mother is exactly 4 times Ravi's age. How old will Ravi be when his mother is exactly 2 times Ravi's age?

(Total for Question 1 is 2 marks)

- 2** A jar contains only 10p and 50p coins. There are 19 coins in total, worth £4.30 altogether. How many 50p coins are in the jar?

(Total for Question 2 is 3 marks)

- 3** Three friends - Ben, Cara and Dan - each choose a different fruit for their lunch box: apple, pear or plum.
- Ben does not choose apple or pear.
- Dan chooses pear.
Work out which fruit Cara chooses.

(Total for Question 3 is 2 marks)

- 4** Using the digits 3, 6 and 9, with each digit used at most once, how many different two-digit odd numbers can be made?

(Total for Question 4 is 2 marks)

- 5 Hana thinks of a number. She doubles it, then adds 9. She then subtracts 5 and divides the result by 2, giving a final answer of 14. What number did Hana start with?

(Total for Question 5 is 3 marks)

- 6 A paint mixture is made by mixing blue paint and white paint in the ratio 2:7. If 45 litres of the mixture are made in total, how many more litres of white paint than blue paint are used?

(Total for Question 6 is 3 marks)

- 7 The sum of the ages of a father and his son is 56. In 4 years' time, the father will be exactly 3 times as old as the son. How old is the son now?

(Total for Question 7 is 3 marks)

- 8 Marcus spent $\frac{1}{4}$ of his money on a book. He then spent $\frac{1}{3}$ of what remained on a game, which left him with £15. How much money did Marcus start with?

(Total for Question 8 is 3 marks)

- 9 Using the digits 1, 3, 5, 7 and 9, how many three-digit numbers can be formed that are multiples of 5, if all three digits in the number must be different?

(Total for Question 9 is 3 marks)

- 10** The first term of a sequence is 3 and the second term is 4. Every term after that is found by adding the two previous terms together and then adding 2. Find the sixth term of the sequence.

(Total for Question 10 is 3 marks)

- 11** Four pupils - Wren, Xavier, Yasmin and Zack - each play one sport: netball, hockey, tennis or badminton.
- Xavier plays hockey.
 - Zack's sport is tennis.
 - Wren does not play badminton.
- Work out which sport Wren plays and which sport Yasmin plays.

(Total for Question 11 is 3 marks)

- 12** Concrete is made from sand and cement mixed in the ratio 5:2. A builder makes 35 kg of concrete. How many kilograms of cement does he use?

(Total for Question 12 is 2 marks)

- 13** A three-digit number is formed using each of the digits 2, 5 and 8 exactly once. How many of the possible three-digit numbers are both greater than 500 and even?

(Total for Question 13 is 3 marks)

- 14** A number has 5 added to it. The result is multiplied by 3, then 6 is subtracted, and finally the result is divided by 3, giving a final answer of 11. Work out the original number.

(Total for Question 14 is 3 marks)

- 15** Priya, Sam and Talia have 6, 9 and 13 marbles between them, though not necessarily in that order.
- Priya has fewer marbles than Sam.
 - Talia does not have the fewest marbles.
 - Sam does not have 13 marbles.
- Work out how many marbles each person has.

(Total for Question 15 is 3 marks)

- 16** After spending $\frac{2}{5}$ of her money on rent, and then $\frac{3}{8}$ of what remained on food, Naomi has £54 left. How much money did Naomi start with?

(Total for Question 16 is 3 marks)

- 17** A three-digit number is formed by choosing 3 of the 4 digits 1, 4, 6 and 8, with no digit repeated. How many of the possible three-digit numbers are both greater than 400 and even?

(Total for Question 17 is 3 marks)

- 18** A jug holds 15 litres of squash made from cordial and water mixed in the ratio 1:4 (cordial:water). Extra cordial is added, without adding any more water, to strengthen the mixture to a ratio of 1:2. How many litres of cordial must be added?

(Total for Question 18 is 3 marks)

- 19** A tiling pattern follows the rule 6, 11, 16, 21, ... with the same difference between consecutive terms. How many tiles are needed for the 14th pattern in the sequence?

(Total for Question 19 is 3 marks)

- 20** Four friends - Aaliyah, Ben, Cass and Dev - each saved a different amount of money for a trip: £20, £35, £50 and £65.
- Aaliyah saved more than Ben but less than Dev.
 - Cass saved the least amount of the four.
- Work out how much each person saved.

(Total for Question 20 is 4 marks)

- 21** Two friends, Tom and Sana, together have £52. After Tom gives Sana £8, Sana then has exactly 3 times as much money as Tom. How much money did Tom have originally?

(Total for Question 21 is 3 marks)

- 22** In a sequence, the first term is 2. Every term after that is found by doubling the previous term and then adding 3. Find the sixth term of the sequence.

(Total for Question 22 is 3 marks)

- 23** A box contains 6 different coloured ribbons: red, blue, green, yellow, purple and gold. Four pupils sitting in a row each take one ribbon, so that no colour is used twice. How many different arrangements are possible in which the gold ribbon is given to one of the four pupils?

(Total for Question 23 is 4 marks)

- 24** A stationery box contains only pens and pencils.

(a) There are 5 more pencils than pens, and 35 items in total. How many pens are there? (2)

(b) Each pen weighs 12 g and each pencil weighs 8 g. What is the total weight of the items in the box, in kilograms? (3)

(Total for Question 24 is 5 marks)

25 At a school fair, three stalls - Toys, Sweets and Raffle - each raised a different amount of money: £18, £36 and £54.

- The Raffle stall raised exactly twice as much as the Toys stall.

- The Sweets stall did not raise the least amount.

Work out how much money each stall raised.

(Total for Question 25 is 4 marks)

26 A market trader needs to give a customer exactly 90p in change, using only 20p, 10p and 5p coins. She must use at least one of each type of coin. In how many different ways can she make the 90p?

(Total for Question 26 is 4 marks)

Mark scheme · EP.M88 Multi-Step Reasoning Challenge Set 3

Question 1

- **M1** forms an equation such as $32 + t = 2(8 + t)$, where t is the number of years from now (oe)
- **A1** 24 cao
- **Answer: Ravi will be 24 years old (his mother will be 48)**

Question 2

- **M1** forms $x + y = 19$ and $10x + 50y = 430$, where x is the number of 10p coins and y the number of 50p coins (oe)
- **M1** divides the value equation by 10 to get $x + 5y = 43$, then subtracts $x + y = 19$ to get $4y = 24$ (oe)
- **A1** 6 fifty pence coins cao
- **Answer: 6 fifty pence coins (and 13 ten pence coins)**

Question 3

- **B1** identifies Ben's fruit as plum, the only one left once apple and pear are ruled out (oe)
- **B1** Cara's fruit is apple cao
- **Answer: Cara chooses apple**

Question 4

- **M1** recognises that 3 and 9 are the only digits in this set that can be the units digit of an odd number (oe)
- **A1** 4 cao (the numbers 39, 69, 63 and 93)
- **Answer: 4 (the numbers 39, 69, 63 and 93)**

Question 5

- **M1** forms the equation $(2x + 9 - 5) / 2 = 14$, where x is the starting number (oe)
- **M1** simplifies to $2x + 4 = 28$ (oe)
- **A1** 12 cao
- **Answer: 12**

Question 6

- **M1** finds the total number of parts $= 2 + 7 = 9$ (oe)
- **M1** finds 1 part $= 45 / 9 = 5$ litres, so blue paint $= 10$ litres and white paint $= 35$ litres (oe)
- **A1** 25 litres cao
- **Answer: 25 litres**

Question 7

- **M1** sets up $f + s = 56$, so $f = 56 - s$ (oe)
- **M1** forms $(56 - s) + 4 = 3(s + 4)$ (oe)
- **A1** 12 cao
- **Answer: The son is 12 now (the father is 44)**

Question 8

- **M1** recognises the £15 remaining is $2/3$ of the amount left after the book, so finds 15 divided by $2/3 = £22.50$ (oe)
- **M1** recognises £22.50 is $3/4$ of the original amount, so finds 22.50 divided by $3/4 = £30$ (oe)
- **A1** £30 cao
- **Answer: £30**

Question 9

- **M1** recognises the units digit must be 5, the only multiple of 5 available (oe)
- **M1** finds the hundreds digit has 4 choices and the tens digit has 3 remaining choices (oe)
- **A1** 12 cao
- **Answer: 12**

Question 10

- **M1** finds the third and fourth terms: $3 + 4 + 2 = 9$, then $4 + 9 + 2 = 15$ (oe)
- **M1** finds the fifth term: $9 + 15 + 2 = 26$ (oe)
- **A1** 43 cao, from $15 + 26 + 2$
- **Answer: 43**

Question 11

- **M1** recognises the two remaining sports for Wren and Yasmin are netball and badminton (oe)
- **A1** Wren plays netball cao
- **A1** Yasmin plays badminton cao
- **Answer: Wren plays netball, Yasmin plays badminton**

Question 12

- **M1** recognises cement makes up $\frac{2}{7}$ of the total mixture (oe)
- **A1** 10 kg cao
- **Answer: 10 kg**

Question 13

- **M1** lists all 6 permutations of 2, 5 and 8: 258, 285, 528, 582, 825, 852 (oe)
- **M1** identifies which are greater than 500 (first digit 5 or 8): 528, 582, 825, 852 (oe)
- **A1** 3 cao, since only 528, 582 and 852 also end in an even digit
- **Answer: 3 (the numbers 528, 582 and 852)**

Question 14

- **M1** undoes the final division: $11 \times 3 = 33$ (oe)
- **M1** undoes the subtraction and multiplication: $33 + 6 = 39$, then $39 \div 3 = 13$ (oe)
- **A1** 8 cao, from $13 - 5$
- **Answer: 8**

Question 15

- **M1** uses 'Sam does not have 13' to show Sam has 6 or 9 marbles (oe)
- **M1** tests $\text{Sam} = 6$ and rejects it, since Priya would then need fewer than 6, which is impossible, so $\text{Sam} = 9$ (oe)
- **A1** Priya = 6, Sam = 9, Talia = 13, all cao
- **Answer: Priya has 6 marbles, Sam has 9 marbles, Talia has 13 marbles**

Question 16

- **M1** recognises the £54 remaining is $\frac{5}{8}$ of the amount left after rent, so finds 54 divided by $\frac{5}{8} = £86.40$ (oe)
- **M1** recognises £86.40 is $\frac{3}{5}$ of the original amount, so finds 86.40 divided by $\frac{3}{5} = £144$ (oe)
- **A1** £144 cao
- **Answer: £144**

Question 17

- **M1** identifies the hundreds digit must be 4, 6 or 8 for the number to exceed 400 (digit 1 is too small) (oe)
- **M1** for each of the 3 hundreds digits, finds 2 choices of even units digit and 2 remaining choices of tens digit, giving $3 \times 2 \times 2$ (oe)
- **A1** 12 cao
- **Answer: 12**

Question 18

- **M1** finds the current amounts: cordial = 3 litres, water = 12 litres, from the ratio 1:4 of 15 litres (oe)
- **M1** forms the equation $(3 + x):12 = 1:2$, where x is the cordial added (oe)
- **A1** 3 litres cao
- **Answer: 3 litres**

Question 19

- **M1** finds the common difference is 5 (oe)
- **M1** forms the nth term rule $5n + 1$, or builds the sequence up to the 14th term systematically (oe)
- **A1** 71 cao
- **Answer: 71**

Question 20

- **B1** Cass saved £20, the least amount, cao
- **M1** recognises the remaining three amounts must be assigned in increasing order Ben < Aaliyah < Dev (oe)
- **A1** Ben = £35 and Aaliyah = £50 cao
- **A1** Dev = £65 cao
- **Answer: Cass £20, Ben £35, Aaliyah £50, Dev £65**

Question 21

- **M1** forms $t + s = 52$ and $s + 8 = 3(t - 8)$, where t and s are Tom's and Sana's original amounts (oe)
- **M1** substitutes $s = 52 - t$ and solves to give $t = 21$ (oe)
- **A1** £21 cao
- **Answer: £21**

Question 22

- **M1** finds the second and third terms: $2 \times 2 + 3 = 7$, then $2 \times 7 + 3 = 17$ (oe)
- **M1** finds the fourth and fifth terms: $2 \times 17 + 3 = 37$, then $2 \times 37 + 3 = 77$ (oe)
- **A1** 157 cao, from $2 \times 77 + 3$
- **Answer: 157**

Question 23

- **M1** finds the total number of ways to give 4 different-coloured ribbons to 4 pupils with no restriction: $6 \times 5 \times 4 \times 3 = 360$ (oe)
- **M1** chooses which of the 4 pupils receives the gold ribbon: 4 ways (oe)
- **M1** finds the remaining 3 pupils receive 3 of the remaining 5 colours, in order: $5 \times 4 \times 3 = 60$ ways (oe)
- **A1** 240 cao, from 4×60
- **Answer: 240**

Question 24

- (a) **M1** forms $2p + 5 = 35$, where p is the number of pens (oe)
- (a) **A1** 15 cao
- (a) **Answer: 15 pens**
- (b) **M1** finds the pens' weight: $15 \times 12 = 180$ g (ft from a)
- (b) **M1** finds the pencils' weight: $20 \times 8 = 160$ g (ft from a)
- (b) **A1** 0.34 kg cao
- (b) **Answer: 0.34 kg**

Question 25

- **M1** tests each pair of the three values for a doubling relationship and finds only 18 and 36 work, since $36 = 2 \times 18$ (oe)
- **A1** Toys = £18 and Raffle = £36 cao
- **B1** Sweets must be the remaining value, £54, cao
- **B1** checks Sweets (£54) is not the least amount, since the least is Toys (£18), so the clue is satisfied (oe)
- **Answer: Toys £18, Raffle £36, Sweets £54**

Question 26

- **M1** recognises at most 3 twenty pence coins can be used, since at least one 10p and one 5p coin must remain (oe)
- **M1** for each number of 20p coins used (1, 2 or 3), systematically counts the valid combinations of 10p and 5p coins that make up the rest, e.g. with one 20p coin there are 6 ways (oe)
- **A1** finds 6, 4 and 2 ways respectively for 1, 2 and 3 twenty pence coins, all cao
- **A1** 12 cao, from $6 + 4 + 2$
- **Answer: 12 ways**