**GCSE Mathematics**

**1MA1**

**Problem-solving questions 2**

**Foundation Tier**

**Time: 2 hours**

You should have: Ruler graduated in centimetres and millimetres, protractor, pair of compasses, pen, HB pencil, eraser.

Calculator permitted

Questions with \* could be seen on Higher Tier

**1.** The diagram shows a parallelogram drawn on a centimetre square grid.

On the grid, draw a triangle that has the same area as the parallelogram.

**(Total for question 1 is 2 marks)**

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

**2.** Here is a petrol gauge for a petrol tank.



When it is full the petrol tank holds 56 litres of petrol.

One litre of petrol costs £1.20

How much more will it cost to fill the tank up with petrol?

**(Total for question 2 is 3 marks)**

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

**3.** Here is a square

2 cm

2 cm

Some of these squares can be used to make rectangle A and rectangle B.

Rectangle B

10 cm

4 cm

8 cm

Rectangle A

6 cm

Avi says that you need 2 more squares to make rectangle A than to make rectangle B.

Is Avi correct?

You must show all your working.

**(Total for question 3 is 3 marks)**

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

**4.** The diagram shows a rectangle *ABCD* and a shaded parallelogram *EBFD*.

2 cm

*A*

*B*

*E*

6 cm

  *F C*

*D*

*C*

*F*

10 cm

Work out the area of the shaded parallelogram.

**(Total for question 4 is 3 marks)**

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

**5.** The table shows information about the cost of hiring a concrete mixer from two companies.

|  |
| --- |
| **Cost of hiring concrete mixer** |
| **Company** | **First day** | **All other days** | **Delivery and collection** |
| Hanover | £16.75 | £6.95 | Free |
| Windsor | £8.90 | £8.25 | £7.50 |

Hugh wants to hire a concrete mixer for 8 days.
He will hire the concrete mixer from either Hanover or Windsor.
Hugh wants to pay the least amount of money.

Which company should he choose?
Show how you get your answer.

**(Total for question 5 is 3 marks)**

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

**6.** A supermarket is carrying out a promotion in January.

Andrew is collecting vouchers from the supermarket.

Each red voucher is worth 5 points.

Each blue voucher is worth 9 points

Each yellow is worth 12 points.

Andrew collects 120 vouchers in January.

of the vouchers are red.

35% of the vouchers are blue.

The rest of the vouchers are yellow.

To get a prize Andrew must collect at least 1000 points in January.

Will Andrew get a prize in January?

You must show how you get your answer.

**(Total for question 6 is 5 marks)**

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

**7.** Anish is a student.

He wants buy a jumper online.

The jumper is sold in two online shops, shop A and shop B.

**Shop B**

Jumper

£39.60

Students get price reduced

by 45%

Delivery charge £2.50

**Shop A**

Jumper

£32 plus VAT at 20%

Students get price reduced

by a third

Free delivery

Anish wants to pay the least amount of money for the jumper.

Which online shop should Anish choose?

You must show your working.

**(Total for question 7 is 4 marks)**

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

**8.** Here are the first four numbers of an arithmetic sequence

 −3 1 5 9

1. Work out, in terms of *n*, the *n*th term of the arithmetic sequence.

**(2)**

The *n*th term of a different arithmetic sequence is 9*n* – 52

1. Find a number that is in both sequences.

**(2)**

**(Total for question 8 is 4 marks)**

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

**9.** A factory makes wooden blocks in the shape of a cuboid.

Each wooden block measures 16 cm by 8 cm by 15 cm.

The wooden blocks are packed into boxes.

Each box measures 0.8 m by 1.2 m by 1.5 m.

Work out the greatest number of wooden blocks that can be packed in each box.

**(Total for question 9 is 4 marks)**

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

**10.** Jean wants to paint a rectangular wall in her garden.

The wall is 1.8 m high and 36 m long.

1.8 m

36 m

She finds some information about tins of paint.

Paint is sold in 1.5 litre tinsand 5 litre tins.

Each 5 litre tin costs £12.50

Each 1.5 litre tin costs £3.75

One litre of paint covers 6 m2.

Jean wants to pay the least amount of money.

Work out the cost of the paint Jean needs to buy.

You must show your working.

**(Total for question 10 is 5 marks)**

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

**11.** Erin sells homemade strawberry jam in jars.

The table shows her sales for the first 3 weeks.

|  |  |
| --- | --- |
| **Week** | **Number of jars sold** |
| 1 | 18 |
| 2 | 37 |
| 3 | 26 |

The mean number of jars sold in the first 4 weeks was 30 jars.

Work out how many jars were sold in week 4

**(Total for question 11 is 3 marks)**

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

**12.** Here is a square and a rectangle.

Area

= 100 cm2

Rectangle

 Width

 Length

The square has an area of 100 cm2.

The length of the rectangle is three times the width of the rectangle.

The perimeter of the square is the same as the perimeter of the rectangle.

Work out the area of the rectangle.

**(Total for question 12 is 5 marks)**

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

**13.** *ABC* is an isosceles triangle.

*B*

*C*

*A*

(4*x* + 35)°

(*x* + 50)°

Work out the size of angle *ABC*.

**(Total for question 13 is 4 marks)**

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

**\*14.** Here is some information about the sports played by members of a sports club.

 90 people are members of the club.

 44 members play tennis.

 32 members play badminton.

 14 members play tennis and badminton.

1. Draw a Venn diagram to show this information.

**(3)**

One of the members is chosen at random.

1. Work out the probability that this member does not play badminton and does not play tennis.

**(2)**

**(Total for question 14 is 5 marks)**

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

**\*15.** Asha and Pam share £360 in the ratio 4:5

Pam then gives some of her money to Asha so that they each have the same amount.

Work out how much money Asha gives to Pam.

**(Total for question 15 is 3 marks)**

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

**\*16.** Here is a 4-sided spinner.

The sides of the spinner are labelled 1, 2, 3 and 4

The spinner is biased.

The probability that the spinner will land on 1 and the probability that the spinner will land on 3 is given in the table.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Number**  | **1** | **2** | **3** | **4** |
| **Probability** | 0.32 |  | 0.23 |  |

The probability that the spinner will land on 2 is **twice** the probability that it will land on 4

Sandeep is going to spin the spinner 400 times.

Work out an estimate for the number of times it will land on 2

**(Total for question 16 is 4 marks)**

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

**\*17.** Three apples and four bananas cost 90p

One apple and two bananas cost 40p

Work out the cost of one apple and the cost of one banana.

**(Total for question 17 is 4 marks)**

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

**18.** Joy found an object on a beach in the shape of a cuboid.

3.7 cm

5.4 cm

6.2 cm

The mass of the object is 1.23 kg.

|  |  |
| --- | --- |
| **Metal** | **Density g/cm3** |
| Brass  | 8.73 |
| Bronze | 9.90 |
| Copper | 8.60 |

Joy thinks that the object is made of bronze.

Use the information in the table to see if Joy could be correct.

You must show your working.

**(Total for question 18 is 4 marks)**

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

**\*19.** The diagram shows two identical squares.

B

A

Diagram A shows a shaded circle inside a square.

Diagram B shows a shaded quarter circle inside a square.

Is the shaded area in diagram A equal to the shaded area in diagram B?

You must show your working.

**(Total for question 19 is 3 marks)**

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

**\*20.** The diagram shows two triangles, *ABD* and *BCD*.

*B*

*C*

*A*

40°

16.4 m

12.2 m

*D*

*ADC* is a straight line.

Work out the length of *AD*.

Give your answer correct to 3 significant figures.

**(Total for question 20 is 3 marks)**

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

| **Qn** | **Answer** | **Mark** | **Notes** |
| --- | --- | --- | --- |
| **1** | Correct diagram | 2 | P1 process to work out the area of the parallelogram, e.g. 4 + 1 + 1A1 correct triangle drawn with an area of 6cm2 |
| **2** | £50.40 | 3 | P1 process to find a fraction of a quantity, e.g.  × 56 (= 14) or  × 56 (= 42) P1 process to find the cost of the petrol needed, e.g. “42” × 1.2 or 56 × 1.2 ̶ “14” × 1.2A1 £50.4(0)  |
| **3** | Yes with correct working | 3 | P1 process to find the number of squares for rectangle A or rectangle B or using a strategy to see how many square fit into the rectangles, e.g. 8 × 6 ÷ 2 × 2 or 10 × 4 ÷ 2 × 2 or 4 × 3 or 5 × 2(This could be drawn on the diagram) P1 process to find the difference in the number of squares,e.g. “48” ÷ “4” ̶ “40” ÷ “4” or “(48 – 40)” ÷ 4 or 12 − 10 *(this could come from drawing 12 squares and 10 squares on the diagrams*) or 4 × 3 − 5 × 2C1 Yes with 12 and 10 seen  |
| **4** | 48 | 3  | P1 process to find the area of the rectangle or a triangle or the length of *DF* or *BE*, e.g. 6 × 10 = 60 or 0.5 × 2 × 6 = 6 or 10 – 2 = 8P1 correct process to find the shaded area, e.g. “60” – “6” – “6” or “8” × 6A1 cao |
| **5** | Hugh and reason | 3  | P1 process to find the cost of Hanover or Windsor,e.g. [16.75 + 7(6.95)] or [8.90 + 7(8.25) + 7.5]P1 process to find the cost of Hanover and Windsor,e.g. [16.75 + 7(6.95) + 0] and [8.90 + 7(8.25) + 7.5]C1 for 65.4(0) and 74.15 and Hugh should choose Hanover as it is cheaper oe |
| **6** | Yes as 1034 is greater than 1000 | 5 | P1 process to find the number of red vouchers or number of blue vouchers, e.g. × 120 = 40 or 35% of 120 = 42P1 process to find the number of yellow vouchers, e.g. 120 – “40” – “42” = 38P1 process to find the value of the points, e.g. “40” × 5 or “42” × 9 or “38” × 12P1 process to find the total value of the points, e.g. “40” × 5 + “42” × 9 + “38” × 12C1 1034 and correct conclusion |
| **7** | Shop B and reason | 4 | P1 process to calculate a reduction, e.g. × 32P1 process to work with percentages,e.g. to find 20% or 80% or 45% or 55% of amountsP1 complete process to find total cost for shop A and shop B, e.g.( $\frac{2}{3}×39.60$) or (0.55 × 39.60 + 2.50)C1 25.60 and 24.28 and decision, e.g. Shop B because it is cheaper  |
| **8****(a)** | 4*n* – 7  | 2 | P1 process to work out the *n*th term, e.g. 4*n* ± kA1 4*n* – 7 |
| **8****(b)** |  | 2 | P1 (dep on P1 in (a)) Process to find the common number, e.g. "4*n* – 7" = 9*n* – 52 or lists at least 5 numbers in the 2nd sequenceA1 for 29 or 65 or 101 etc |
| **9** | 750 | 4 | P1 process to convert units, e.g. 16 cm = 0.16 m or 0.8 m = 80 cm (may be implied later)P1 process to find the volume, e.g. 16 × 8 × 15 = 1920 or 0.16 × 0.08 × 0.15 = 0.00192 or 0.8 × 1.2 × 1.5 = 1.44 or 80 × 120 × 150 = 1 440 000P1 process to find the number of blocks, e.g. 1 440 000 ÷ 1920 or 1.44 ÷ 0.00192A1 750ALTERNATIVEP1 process to convert units, e.g. 14.2 cm = 0.142 m or 0.8 m = 80cm (may be implied later)P1 process to find scale factors, e.g. 80 ÷ 16 and 120 ÷ 8 and 150 ÷ 15 or 0.8 ÷ 0.16 and 1.2 ÷ 0.08 and 1.5 ÷ 0.15 P1 process to find the number of blocks, e.g. 5 × 15 × 10A1 750 |
| **10** | 27.50 | 5 | P1 process to find the area of the wall, e.g. 1.8 × 36 = 64.8P1 process to work out the amount of litres needed, e.g. “64.8” ÷ 6 = 10.8 (or = 11 litres)P1 process to find the number of tins, e.g. “10.8” ÷ 5 = 2.16 = 3 tins or “10.8” ÷ 1.5 = 7.2 = 8 tinsP1 process to work out the cheapest combination of tins, e.g. “3” × 12.50 or “8” × 3.75 or 2 × 12.50 + 1 × 3.75 or 4 × 3.75 + 1 × 12.50A1 £27.50 |
| **11** | 39 | 3 | P1 process to find the number of jars sold in the first four weeks, e.g. 4 × 30 = 120P1 process to find the number of jars sold in the fourth week, e.g. “120” – (18 + 37 + 26)A1 cao |
| **12** | 75 | 4 | P1 process to find the length of the square, e.g. = 10 P1 process to find the perimeter of the square (or rectangle), e.g. "10" × 4 (= 40)P1 process to find the width and length of the rectangle, e.g. 3*x* + *x* + 3*x* + *x* = "40" or 5 and 15P1 process to find the area of the rectangle, e.g. “5” × “15”A1 cao |
| **13** | 70° | 4 | P1 process to find the value of *x*, e.g. 4*x* + 35 = *x* + 50P1 process to solve the equation, e.g. x = (50 − 35) ÷ (4 − 1)P1 process to work out angle *ABC*, e.g. 180 – “55” – “55”A1 70  |
| **\*14 (a)** | Correct Venn diagram | 3 | P1 start the process to interpret the information given, e.g. two circles overlapping and correct labelsP1 process to enumerate the Venn diagram, e.g. at least 2 correct from 14 or 30 or 18 or 28A1 correct Venn diagram with 14, 30, 18 and 28 in the correct regions and correctly labelled |
| **\*14 (b)** |  | 2 | P1 process to identify correct region in the Venn diagram, e.g. “28” ÷ 90 A1  oe |
| **\*15** | 20 | 3 | P1 process to start to find a share for Asha or Pam, e.g. 4*x* + 5*x* = 360 or 360 ÷ 9 = 40 or 160 or 200P1 process to find the amount of money given, e.g. (“200” – “160”) ÷ 2 or (360 ÷ 2) – “160” or “200” – (360 ÷ 2)A1 cao |
| **\*16** | 120 | 4 | P1 process of subtraction of probabilities from 1, e.g. 1 – 0.32 – 0.23 = 0.45P1 process for find the probability on landing on 2, e.g. “0.45” ÷ 3 × 2 = 0.3P1 process to estimate the number of times it will land on 2, e.g. “0.3” × 400A1 cao |
| **\*17** | Apple is 10pand banana is 15p | 4 | P1 process to set up two equations, e.g. 3*a* + 4*b* = 90 and *a* + 2*b* = 40M1 correct method to eliminate one variableM1 correct method to find the second variableA1 cao |
| **18** | Joy is correct and reason | 4 | P1 process to find the volume of the object, e.g. 6.2 × 5.4 × 3.7 (= 123.876)P1 process to convert units, e.g. 1.23 × 1000 (= 1230)P1 process to see if Joy is correct e.g. (density =) 1230 ÷ “123.876” (= 9.93) e.g. (mass =) 9.9 × “123.876” (= 1226.3724)C1 Joy is correct and reason from correct figuresAccept Joy is wrong as brass is 9.90 and this object has density 9.92 |
| **\*19** | Yes  | 3 | P1 process to find the area of circle in diagram A, e.g. P1 process to find the area of circle in diagram B, e.g. C1 Yes and both areas correct |
| **\*20** | 6.14 | 3 | P1 process to find the length of *BD*, e.g. 16.4 × sin40 (= 10.54 to 10.55)P1 process to find the length of *AD*, e.g. A1 6.14 to 6.21 |