**GCSE Mathematics**

**1MA1**

**Problem-solving questions 1**

**Foundation Tier: Silver**

**Time: 1 hour 30 minutes**

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

Calculator permitted

Questions with \* could be seen on Higher Tier

**1.** Here is part of a special menu.

A meal is 1 drink

1 sandwich

1 cake

You can buy a meal from this menu.

|  |  |  |
| --- | --- | --- |
| **Drinks** | **Sandwiches** | **Cakes** |
| Tea 58p  Coffee 55p  Hot milk 60p | Cheese 78p  Ham 82p  Tuna 80p | Scone 45p  Cream 50p  Iced bun 42p |

Tom has £20 to spend.

(a) Work out the cost of the cheapest meal.

**(1)**

(b) What is the greatest number of meals he can buy from this special menu?

You must show how you get your answer.

**(2)**

**(Total for question 1 is 3 marks)**

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

**2.** Jim has three rectangular pieces of wood.

Each piece of wood has length of 40 cm and a width of 20 cm.

The diagram shows one piece of wood.

20 cm

40 cm

The three pieces of wood can be placed next to each other in different ways to make a larger rectangle.

(a) Draw diagrams to show the different ways a larger rectangle can be made with the three pieces of wood.

**(1)**

(b) Work out the perimeters of these larger rectangles.

**(1)**

(c) State the smallest possible perimeter of this large rectangle.

**(1)**

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

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

**3.** Kamran wants to rent his flat.

He finds information about three estate agents.

Each estate agent will charge a fee.

The fee, in £, is given below from these three estate agents.

|  |  |
| --- | --- |
| **Saturn** | **Crown** |
| *C* = 12.5 + 0.1*R*  *C* = cost of fee in pounds (£)  *R* = monthly rent in pounds (£) | *C* = 0.12*R*  *C* = cost of fee in pounds (£)  *R* = monthly rent in pounds (£) |

|  |
| --- |
| **Romleys** |
| The line graph gives the cost.  1000  Cost (£)  800  600  400  200  0  120  100  80  60  40  20  0  Rent (£) |

Kamran wants to rent his flat for £820 per month.

Kamran wants to pay the least amount of fee.

(a) Work out the cost of the fee, in £, for each estate agent.

**(2)**

(b) Which estate agent should Kamran choose?

**(1)**

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

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

**4.** *ABCDE* is a pentagon.

*B*

*A*

*C*

*D*

*E*

3*x*°

(5*x* – 82)°

*AB* = *BC*

*AE* = *CD*

Angle *AED* = angle *CDE* = 90°

(a) Find the value of *x*.

**(2)**

(b) Work out the size of angle *ABC* in the pentagon *ABCDE*.

**(2)**

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

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

**5.** The diagram shows a plan of a patio.

All the angles are right angles.

2.4 m

2.4 m

1.5 m

1.5 m

5 m

12 m

*A*

*B*

*C*

*D*

*E*

*F*

*G*

*H*

Sandeep is going to use some weed killer on the patio.

He needs 1 litre of weed killer every 6 m2 of patio.

There are 1.75 litres of weed killer in each bottle of weed killer.

(a) Work out the area, in m2, of rectangle *FEDH*.

**(1)**

(b) Work out the area, in m2, of rectangle *ABCH*.

**(1)**

(c) Work out the area, in m2, of the patio.

**(1)**

(d) How many bottles of weed killer does Sandeep need to buy?

**(2)**

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

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

**6.** Anna is going to deliver some goods.

She charges £8.50 per hour and 12p per mile for delivery.

She writes down her mileage before and after she has made the journey.

|  |  |
| --- | --- |
| **Before** | **After** |
| 26985 | 27125 |

This journey takes 3 hours and 30 minutes.

(a) Work out the cost, in £, of the miles she has travelled.

**(1)**

(b) Work out the cost, in £, of the hours she has travelled.

**(1)**

(c) How much does she charge to deliver these goods?

**(1)**

**(Total for question 6 is 3 marks)**

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

**7.** A cake shop orders six bags of sugar.

Each bag of sugar weighs 1.25 kg.

The sugar is used in the ingredients to make a sponge cake.

Each sponge cake contains 90g of sugar.

(a) Work out the total weight, in g, of the six bags of sugar.

**(1)**

(b) How many cakes can be made by using the six bags of sugar?

**(2)**

**(Total for question 7 is 3 marks)**

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

**8.** 9 dancers entered a dancing competition.

Here are their marks.

6.9 5.8 8.9 9.1 6.2 5.7 8.4 5.9 6.1

The dancers who scored more than the **mean** of these marks were entered into the next round.

(a) Work out the mean of the 9 dancers.

**(1)**

(b) Work out the percentage of these dancers who were entered into the next round.

Give your answer correct to 3 significant figures.

**(2)**

**(Total for question 8 is 3 marks)**

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

**9.** Jean owns an Art Gallery.

For the last six months she worked out the following:

7254 people visited the gallery

It was open for 1240 hours in total

For 30% of the time the gallery was open she had 4 visitors per hour

For  of the time the gallery was open she had 6 visitors per hour

(a) Work out the number of visitors for 30% of the time.

**(1)**

(b) Work out the number of visitors for a  of the time.

**(1)**

(c) Work out the remaining number of hours.

**(1)**

(d) Work out the remaining number of visitors.

**(1)**

(e) Work out the mean number of visitors per hour visiting the gallery for the remaining time.

**(2)**

**(Total for question 9 is 6 marks)**

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

**10.** The diagram shows a template of eight identical circles placed on a rectangular sheet of card.

96 cm

*A*

*B*

*C*

*D*

*AB* = 96 cm

Each corner of the smaller white rectangle is at the centre of a circle.

(a) Work out the area of rectangle *ABCD*.

**(1)**

(b) Work out the area of the smaller white rectangle.

**(1)**

(c) Work out the shaded area.

**(2)**

**(Total for question 10 is 4 marks)**

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

**11.** The table shows information about the number of hours that 150 children used a computer last week.

|  |  |
| --- | --- |
| **Number of hours (*h*)** | **Frequency** |
| 0 < *h* ≤ 2 | 15 |
| 2 < *h* ≤ 4 |  |
| 4 < *h* ≤ 6 | 35 |
| 6 < *h* ≤ 8 | 45 |
| 8 < *h* ≤ 10 |  |
| 10 < *h* ≤ 12 | 10 |

There were twice as many children who used a computer between 8 to 10 hours as compared to the numbers of children who used a computer between 2 to 4 hours.

Stephen says:

“I think 36% of the children used their computer for more than 8 hours.”

(a) Write down the number of children who used a computer between

(i) 2 to 4 hours,

(ii) 8 to 10 hours.

**(2)**

(b) Work out the percentage of children who used their computer for more than 8 hours.

**(1)**

(c) Is Stephen correct? Give a reason for your answer.

**(1)**

**(Total for question 11 is 4 marks)**

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

**\*12.** Angela, Barry and Charlie walk 48 miles in total for charity.

The ratio of the number of miles walked by Angela to the number of miles walked by Barry is 3:5

Barry walks 8 miles more than Angela.

They want to draw a pie chart to show this information.

(a) Work out the number of miles Angela walks and the number of miles Barry walks.

**(1)**

(b) Work out the number of miles Charlie walks.

**(1)**

(c) Work out the angle of the sector for this pie chart for Charlie.

**(2)**

**(Total for question 12 is 4 marks)**

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

**\*13.** *ABCDE* is a regular pentagon.

*DEFGHI* is a regular hexagon.

*B*

*A*

*E*

*D*

*C*

*F*

*I*

*G*

*H*

(a) Work out the sizes of the exterior angles of the regular polygons.

**(1)**

(b) Work out the size of the angle *AEF*.

**(1)**

(c) Work out the size of angle *EAF*.

**(2)**

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

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

\***14.**

*A*

*B*

*C*

*D*

*E*

14 cm

25 cm

*ABC* is a straight line.

*BCDE* is a rectangle.

The area of the rectangle is 98 cm2.

*ABE* is a right angle.

(a) Work out the length, in cm, of *BE*.

**(1)**

(b) Work out the length, in cm, of *AB*.

**(1)**

(c) Work out the area, in cm2, of triangle *ABE*.

**(2)**

**(Total for question 14 is 4 marks)**

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

**\*15.** Anjali has £8000 to invest in an investment plan.

Here is information about two investment plans.

**Jupiter Investments**

Compound interest

2.5% each year.

**Sterling Services**

Compound interest

3% for the first year.

Then 2.2% each year

Anjali wants to have as much money as possible in her investment plan at the end of two years.

(a) Work out the amount of money at the end of two years in Sterling Services.

**(1)**

(b) Work out the amount of money at the end of two years in Jupiter Investments.

**(1)**

(c) Which is the better investment, Sterling Services or Jupiter Investments?

You must explain your answer.

**(1)**

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

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

**Foundation Problem Solving Questions – Mark schemes**

| **Qn** | **Answer** | **Mark** | **Notes** |
| --- | --- | --- | --- |
| **1(a)**  **(b)** | 175p  11 | 1  2 | P1 for a process to find the cost of a meal  e.g. 55 + 78 + 42 or 55 + 78 + 45  P1 for a complete process to find the number of meals, allow ft for any combination of a meal  e.g. 2000 ÷ (cost of 1 meal)  A1 for 11 from 2000 and 175 |
| **2(a)**  **(b)**  **(c)** | 3 correct rectangles  200, 280, 200  200 | 1  1  1 | P1 for a process to draw three different rectangles.  P1 for a complete process to find the perimeter of three different rectangles  e.g. [(20 + 20 + 20 + 40) × 2] (= 200)  or [(40 + 40 + 40 + 20) × 2] (= 280)  or (20 + 40 + 20 + 20 + 40 + 20 + 40) (= 200)  B1 cao (dependent on 2nd P1) |
| **3(a)**  **(b)** | 94.5, 98.4 and 98 – 102  Saturn with correct working | 2  1 | P1 for a process to calculate the cost with 1 agent.  e.g. 12.5 + 0.1(820) or 0.12(820) or a vertical line drawn at 820 and meeting the graph  P1 for a process to calculate the cost with all 3 agents  e.g. “94.5” and “98.4” and “98 – 102”  C1 for 94.5, 98.4, 98 – 102 with supporting statement |
| **4(a)**  **(b)** | 41°  114 | 2  2 | P1 for process to start solving the problem,  e.g. 5*x* – 82 = 3*x*  P1 for a complete process to solve the equation or *x* = 41  e.g. 5*x* – 3*x* = 82 or 2*x* = 82 or *x* =  P1 complete process to find the size of the missing angle , ft for their *x* (dependent on first or second P1)  e.g. 540 – 90 – 90 – (3 × “41”) – (5 ×“41” – 82)  or (360 – 90 – 90 – 3 × “41”) × 2)  A1 cao |
| **5(a)**  **(b)**  **(c)**  **(d)** | 10.8  60  49.2  5 | 1  1  1  2 | P1 for process to find the area of *FEDH*  e.g. 12 – 2.4 – 2.4 (= 7.2) or 1.5 × “7.2” (= 10.8)  P1 for process to find the area of *ABCD*  e.g. 12 × 5 (= 60)  P1 for process to find the area of the patio  e.g. 60 – “10.8” (= 49.2)  P1 for a process to find number of bottles needed (dependent on 2nd P mark) “49.2” ÷ 6 (= “8.2”)  or “8.2” ÷ 1.75 (= 4.69)  A1 cao |
| **6(a)**  **(b)**  **(c)** | £16.80  £29.75  £46.55 | 1  1  1 | P1 for a process to find the cost for number of miles  e.g. 27125 – 26985 ( = 140) or “140” × 0.12 (= 16.8)  P1 for a process to find the cost for the number of hours  e.g. 3.5 × 8.50 (= 29.75)  B1 correct answer of £46.55 |
| **7(a)**  **(b)** | 7.5  83 | 1  2 | P1 for a process to calculate the total weight of the bags  e.g. 1.25 × 6 (= 7.5) or 1250 × 6 (= 7500)  P1 for a complete process to find the total number of cakes  e.g. “7.5”× 1000 ÷ 90 or “7500” ÷ 90  A1 cao |
| **8(a)**  **(b)** | 7  33.3% | 1  1 | P1 for a process to add up all the numbers and divide by 9; condone 1 missing mark  e.g. (5.7 + ..... + 9.1) ÷ 9 or “63” ÷ 9 or 7  P1 for a process to find the percentage (dependent on first P mark)  e.g. “3” ÷ 9 × 100 = 33.3%  A1 for 33.3% accept 33% |
| **9(a)**  **(b)**  **(c)**  **(d)**  **(e)** | 1488  1860  558  3906  7 | 1  1  1  1  2 | P1 for a process to find the number of visitors  e.g. 0.3 × 1240 (= 372) or 372” × 4 ( = 1488)  P1 for a process to find the number of visitors  e.g. 0.25 × 1240 (= 310) or “310” × 6 ( = 1860)  P1 for a process to find the number of remaining hours  e.g. 0.45 × 1240 (= 558)  P1 for a complete process to find the remaining visitors  e.g. 7254 – “1488” – “1860” ( = 3906)  P1 for a process to find the average number visitors for the remaining time  e.g. “3906” ÷ “558”  A1 cao |
| **10(a)**  **(b)**  **(c)** | 4608  1728  2880 | 1  1  2 | P1 for a process to find the area of the large rectangle  e.g. 96 ÷ 8 (= 12) or 96 ÷ 4 (= 24) or 96 × “48” (= 4608)  P1 for a process to find the area of the small rectangle  e.g. or “72” × “24” (= 1728)  P1 for a process to find the shaded area  e.g. “4608” – “1728”  A1 cao |
| **11(a)**    **(b)**  **(c)** | 15 and 30  26.7  No with correct working | 2  1  1 | P1 for a process to calculate the number of children  e.g. 150 – (15 + 35 + 45 + 10)  A1 for 15 and 30  P1 for a process to find the percentage of children who use a computer for more than 8 hours  e.g. “30” + 10) ÷ 150 × 100  C1 conclusion with correct figures i.e. 26.7% |
| **12(a)**  **(b)**  **(c)** | 12 and 20  16  120° | 1  1  2 | P1 a strategy to start to solve the problem  e.g. 8 ÷ (5 – 3) (= 4) or 3*x* + 8 = 5*x* or 3 × “4” (= 12) or  5 × “4” (= 20)  P1 process to find Charlie’s share  e.g. 48 – 3 × “4” – 5 × “4” (= 16)  P1 process to find the angle for Charlie  e.g. “16”÷ 48 × 360 oe  A1 cao |
| **\*13(a)**  **(b)**  **(c)** | 72 and 60  132  24 | 1  1  2 | P1 for a process to find the interior angle or exterior angle of the pentagon or the hexagon  e.g. 360 ÷ 5 (= 72) or 360 ÷ 6 (= 60)  P1 for a complete process to find angle *AEF*  e.g.”72” + “60” (=132)  P1 for process to find angle *EAF*  e.g. (180 – “132”) ÷ 2  A1 for cao |
| **\*14(a)**  **(b)**  **(c)** | 7  24  84 | 1  1  2 | P1 for a process to find the length of CD  e.g. 98 ÷ 14  P1 for a process to apply Pythagoras theorem to triangle ABE  e.g.  ( = 24)  P1 for a process to find the area of the triangle  e.g. (“24” × “7”) ÷ 2  A1 cao |
| **\*15(a)**  **(b)**  **(c)** | 8421.28  8405  Sterling (with correct working) | 1  1  1 | P1 for a process to find amount for Sterling  e.g. (8000 × 1.03) × 1.022  P1 for a process to find amount for Jupiter  e.g. 8000 × 1.0252  B1 for 8421.28 and 8405 with correct answer with reason |