**GCSE Mathematics**

**1MA1**

**Problem-solving questions 1**

**Foundation Tier**

**Time: 1 hour 30 minutes**

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.** 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 58pCoffee 55pHot milk 60p | Cheese 78pHam 82pTuna 80p | Scone 45pCream 50pIced bun 42p |

Tom has £20 to spend.

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

You must show how you get your answer.

**(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.

Work out the smallest possible perimeter of this larger rectangle.

**(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.1000Cost (£)8006004002000120100806040200Rent (£) |

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

Kamran wants to pay the least amount of fee.

Which estate agent should Kamran choose? You must show all your working.

**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°

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

**(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

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.

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

**(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.

How much does she charge to deliver these goods?

**(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.

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

**(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.

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

Give your answer correct to 3 significant figures.

**(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

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

**(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 rectangle is at the centre of a circle.

Work out the shaded area.

**(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 use a computer between 2 to 4 hours.

Stephen says:

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

Is Stephen correct? You must give reasons for your answer.

**(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.

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

**(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*

Work out the size of angle *EAF*.

 **(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.

Work out the area of triangle *ABE*.

**(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.

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

You must show all your working.

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

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

**BLANK PAGE**

**Foundation Problem Solving Questions – Mark schemes**

| **Qn** | **Answer** | **Mark** | **Notes** |
| --- | --- | --- | --- |
| **1** | 11 | 3 | P1 for a process to find the cost of a meale.g. 55 + 78 + 42 or 55 + 82 + 50P1 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** | 200 | 3 | P1 for a process to find the perimeter of larger rectanglee.g. [(20 + 20 + 20 + 40) × 2] (= 200) or [(40 + 40 + 40 + 20) × 2] (= 280) or (20 + 40 + 20 + 20 + 40 + 20 + 40) (= 200)P1 for a complete process to find the perimeter of at least three different rectanglese.g. “200” , “200” and “280”A1 cao (dependent on 2nd P1) |
| **3** | Saturn with correct working | 3 | 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 graphP1 for a process to calculate the cost with all 3 agentse.g. “94.5” and “98.4” and “98 – 102”C1 for 94.5, 98.4, 98 – 102 with supporting statement  |
| **4** | 114 | 4 | 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* = 41e.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** | 5 | 5 | P1 for process to find one areae.g. [2.4 × 5 ( = 12)] or [2.4 × 1.5 ( = 3.6)] or [12 × ‘3.5’ ( = 42)] or [“3.5” × “7.2” = “25.2”]P1 for a complete process to find the total areae.g. [“3.6” + “3.6”+ “42” (= “49.2”)] or [“12” + “12” + “25.2” (= “49.2”)]P1 for a process to find number of litres needed (dependent on 2nd P mark) “49.2” ÷ 6 (= “8.2”)P1 for a process to find the number of bottles (dependent on 2nd P mark) “8.2” ÷ 1.75 (= “4.6875....”)A1 cao |
| **6** | £46.55 | 3 | P1 for a process to find the number of milese.g. 27125 – 26985 ( = 140) P1 for a complete process to find the total coste.g. (“140” × 0.12) + (3.5 × 8.50)A1 correct answer of £46.55 |
| **7** | 83 | 3 | P1 for a process to calculate the total weight of the bags or number of cakes from one bage.g. 1.25 × 6 (= 7.5) or 1250 ÷ 90 (13.8888)P1 for a complete process to find the total number of cakese.g. “7.5”× 1000 ÷ 90 or (“13.8888” × 6)A1 cao  |
| **8** | 33.3% | 3 | P1 for a process to add up all the numbers and divide by 9; condone 1 missing marke.g. (5.7 + ..... + 9.1) ÷ 9 or “63” ÷ 9 or 7P1 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** | 7 | 6 | P1 for a process to find the number of hourse.g. 0.3 × 1240 (= 372) or (0.25 × 1240 = 310)P1 for a process to find the number of visitorse.g. “372” × 4 ( = 1488) or “310” × 6 ( = 1860)P1 for a complete process to find the remaining visitorse.g. 7254 – “1488” – “1860” ( = 3906)P1 for a process to find the number of remaining hourse.g. 0.45 × 1240 (= 558) P1 for a process to find the average number visitors for the remaining time e.g. “3906” ÷ “558” A1 cao  |
| **10** | 2880 | 4 | P1 for a process to find the radius or diameter of the circlee.g. 96 ÷ 8 (= 12) or 96 ÷ 4 (= 24)P1 for a process to find the area of the large rectangle or the small rectanglee.g. 96 × “48” (= 4608) or “72” × “24” (= 1728)P1 for a process to find the shaded areae.g. “4608” – “1728”A1 cao |
| **11** | No with correct working | 4 | P1 for a process to calculate the number of childrene.g. 150 – (15 + 35 + 45 + 10)A1 for 15 and 30 in the correct placesP1 for a process to find 36% of 150 or find the percentage of children who use a computer for more than 8 hourse.g. (0.36 × 150 and “30”) or ((“30” + 10) ÷ 150 × 100)C1 conclusion with correct figures , 26.7% or 54 |
| **12** | 120° | 4 | P1 a strategy to start to solve the problem e.g. 8 ÷ (5 – 3) (= 4) or 3*x* + 8 = 5*x* oeP1 process to find Charlie’s share e.g. 48 – 3 × “4” – 5 × “4” (= 16) or 48 ÷ “4” – 3 – 5 (= 4) P1 process to find the angle for Charliee.g. “16”÷ 48 × 360 oe or “4” ÷ 12 × 360 oe A1 cao |
| **\*13** | 24 | 4 | P1 for a process to find the interior angle or exterior angle of the pentagon or the hexagone.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”) ÷ 2A1 for cao |
| **\*14** | 84 | 4 | P1 for a process to find the length of CD e.g. 98 ÷ 14P1 for a process to apply Pythagoras theorem to triangle ABEe.g.  ( = 24)P1 for a process to find the area of the trianglee.g. (“24” × “7”) ÷ 2A1 cao |
| **\*15** | Sterling (with correct working) | 3 | P1 for a process to find amount for Sterlinge.g. (8000 × 1.03) × 1.022P1 for a process to find amount for Jupitere.g. 8000 × 1.0252A1 for 8421.28 and 8405 with correct answer with reasonorA1 for 1.05266 and 1.050625 with correct answer with reason |