Write your name here

Surname	Other names

In the style of:
Pearson Edexcel
Level 1/Level 2 GCSE (9 - 1)

Centre Number | | | | | |

Candidate Number | | | | |

Mathematics
Grade 9 type questions
Model Answers

Higher Tier

GCSE style questions arranged by topic

Paper Reference
1MA1/2H

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

Total Marks

Instructions

- Use **black** ink or ball-point pen.
- **Fill in the boxes** at the top of this page with your name, centre number and candidate number.
- Answer **all** questions.
- Answer the questions in the spaces provided
  – *there may be more space than you need.*
- **Calculators may be used.**
- If your calculator does not have a π button, take the value of π to be 3.142 unless the question instructs otherwise.
- Diagrams are **NOT** accurately drawn, unless otherwise indicated.
- You must **show all your working out**.

Information

- The total mark for this paper is 80
- The marks for **each** question are shown in brackets
  – *use this as a guide as to how much time to spend on each question.*

Advice

- Read each question carefully before you start to answer it.
- Keep an eye on the time.
- Try to answer every question.
- Check your answers if you have time at the end.

Turn over ▶

1 258 Year 9 were choosing the subjects they would be taking in Year 10. The table shows information about these students.

	Subject to be studied		
	Geography	**History**	**Spanish**
Male	45	52	26
Female	25	48	62

A sample, stratified by the subject studied and by gender, of 50 of the 258 students is taken.

(a) Work out the number of male students studying Spanish in the sample.

$\frac{26}{258}$ is the fraction of males studying Spanish.

Number in sample:

$\frac{26}{258} \times 50 = 5.04$ .....5.....

(2)

(b) Work out the number of female students in the sample.

Number of females:

$25 + 48 + 62 = 135$

Number of females in sample:

$\frac{26}{258} \times 50 = 26.2$ .....26.....

(2)

(Total for Question 1 is 4 marks)

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2 Prove that $(3x + 1)^2 - (3x - 1)^2$ is a multiple of 4, for all positive integer values of x.

This is a difference of two squares:

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

$(3x + 1 + 3x - 1)(3x + 1 - 3x + 1)$

$= 6x(2)$

$= 12x$

12 is a multiple of 4. Any positive integer multiplied by 12 is a multiple of 4.

(Total for Question 2 is 3 marks)

3

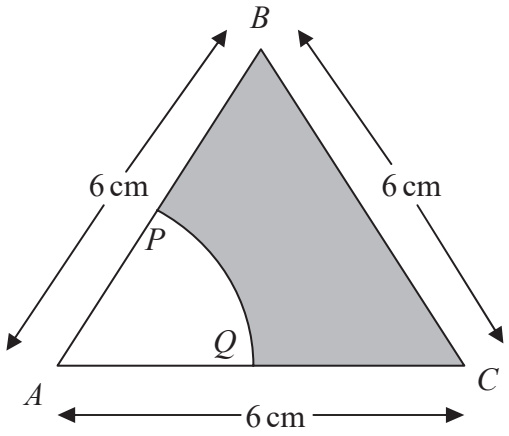


Diagram **NOT** accurately drawn

The diagram shows an equilateral triangle ABC with sides of length 6 cm.

P is the midpoint of AB.
Q is the midpoint of AC.
APQ is a sector of a circle, centre A.

Calculate the area of the shaded region.
Give your answer correct to 3 significant figures.

$$\text{Area of triangle} = \frac{1}{2} \times XY \times YZ \times \sin 60°$$

$$= \frac{1}{2} \times 6 \times 6 \times \sin 60°$$

$$= 15.588$$

$$\text{Area of sector } XPG = \frac{60}{360} \times \pi \times 3^2$$

$$= 4.712$$

$$\text{Area of shaded region} = 15.588 - 4.712$$

$$= 10.876$$

.....10.9..... cm^2

(Total for Question 3 is 4 marks)

4 Make A the subject of the formula

$$x = \sqrt{\frac{A}{3}}$$

$$\frac{A}{3} = x^2$$

$$A = 3x^2$$

$A =$ .....$3x^2$.....

(Total for Question 4 is 2 marks)

---

5 (a) Write 12 500 in standard form.

.....1.25×10^4.....

(1)

(b) Write 2.48×10^{-3} as an ordinary number.

.....0.00248.....

(1)

(c) Work out the value of

$$23\ 500 \div (1.25 \times 10^{-4})$$

Give your answer in standard form.

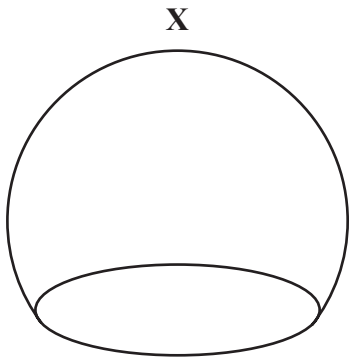
188 000 000

.....1.88×10^8.....

(2)

(Total for Question 5 is 4 marks)

6 **X** and **Y** are two solid shapes which are mathematically similar.
The shapes are made from the same material.



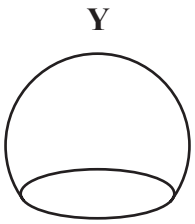


Diagram **NOT** accurately drawn

The surface area of **X** is 50 cm^2.

The surface area of **Y** is 18 cm^2.

The mass of **X** is 500 grams.

Calculate the mass of **Y**.

Ratio of areas is $50 : 18$
$= 25 : 9$

Ratio of lengths is $\sqrt{25} : \sqrt{9}$
$= 5 : 3$

Ratio of volumes is $5^3 : 3^3$
$= 125 : 27$

$$\text{Mass of Y} = 500 \times \frac{27}{125}$$
$$= 108$$

.....108..... grams

(Total for Question 6 is 4 marks)

7 The diagram shows a sector of a circle with centre O.
The radius of the circle is 8 cm.

XYZ is an arc of the circle.
XZ is a chord of the circle.
Angle $XOZ = 40°$

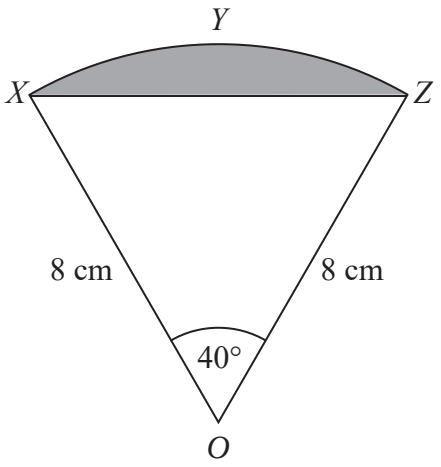


Diagram **NOT** accurately drawn

Calculate the area of the shaded segment.
Give your answer correct to 3 significant figures.

$$\text{Area of sector} = \frac{\Theta}{360}\ \pi r^2$$

$$= \frac{40}{360}\ \pi \times 8 \times 8$$

$$= 22.34$$

$$\text{Area of triangle} = \frac{1}{2}\ OX \times OZ \sin\Theta$$

$$= \frac{1}{2} \times 8 \times 8\sin 40°$$

$$= 20.57$$

$$\text{Area of shaded segment} = 22.34 - 20.57$$

$$= 1.77$$

.....1.77..... cm^2

(Total for Question 7 is 5 marks)

8 The table shows six expressions.
x is a positive integer.

$2x - 3$	$3x - 2$	$3(x + 4)$	$4x + 1$	$4(3x + 1)$	$2x + 1$

(a) From the table, write the expression whose value is

(i) always even

.....4(3x + 1).....

(ii) always a multiple of 3

.....3(x + 4).....

(2)

(b) From the table, write the expression which is a factor of $4x^2 - 1$

Difference of two squares

$(2x + 1)(2x - 1)$

.....2x + 1.....

(1)

(Total for Question 8 is 3 marks)

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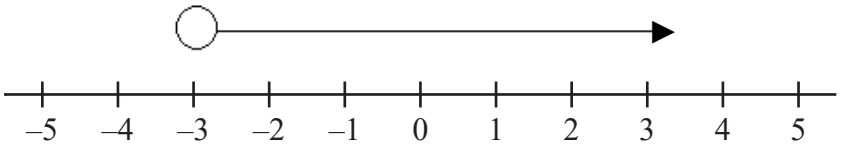
9 (a) $n > -3$

Show this inequality on the number line.



(2)

(b) Solve the inequality $7x + 36 \leq 8$

$7x \leq 8 - 36$

$7x \leq -28$

$x \leq -4$

.....$x \leq -4$.....

(2)

(Total for Question 9 is 4 marks)

10 In a sale the normal price of a pen is reduced by 10%.

The sale price of the pen is £4.86

Calculate the normal price of the pen.

90% of full price is £4.86
10% of full price is £0.54
100% of full price is £5.40

£.....5.40.....

(Total for Question 10 is 3 marks)

11 The diagram shows two similar triangles.

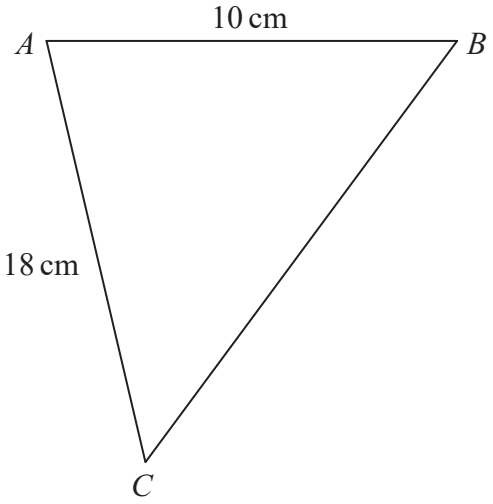
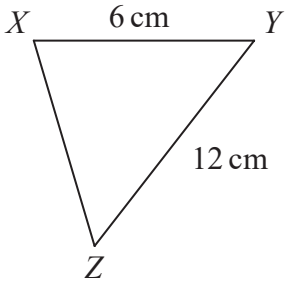


Diagram **NOT** accurately drawn



In triangle ABC, $AB = 10$ cm and $AC = 18$ cm.
In triangle XYZ, $XY = 6$ cm and $YZ = 12$ cm.

Angle ABC = angle XYZ.
Angle CAB = angle ZXY.

(a) Calculate the length of BC.

$$AB : XY$$
$$= 10 : 6$$
$$= 5 : 3$$
$$CB = 12 \times \frac{5}{3}$$
$$= 20$$

.....20..... cm
(2)

(b) Calculate the length of XZ.

$$XZ = 18 \times \frac{3}{5}$$
$$= 10.8$$

.....10.8..... cm
(2)

(Total for Question 11 is 4 marks)

12 The surface area of Venus is 510 072 000 km^2.

The surface area of Jupiter is 6.21795×10^{10} km^2.

The surface area of Jupiter is greater than the surface area of Venus.
How many times greater?
Give your answer in standard form.

$6.217\,95 \times 10^{10} \div 510\,072\,000 = 121.90$

In standard form: 1.219×10^2

(Total for Question 12 is 5 marks)

13 The table shows some expressions.
w, x, y and z represent lengths.
π and 2 are numbers that have no dimensions.

$y^2(x + z)$	$\pi w^2 y^2$	$\frac{w^3 x}{y^3}$	$\pi w^2 x$	$\frac{2w^3 z}{y}$	z^2	$2w + x^2$
✓			✓	✓		

Tick (✓) the boxes underneath the **three** expressions which could represent volumes.

(Total for Question 13 is 3 marks)

14 There are three big employment sites in Knutsford.
The table shows the number of employees in each of these sites.

Barclays	Longridge	Parkgate
750	700	900

Georgina takes a sample of 50 employees stratified by site. Work out the number of employees from Longridge in the sample.

Total number of employees

$750 + 700 + 900 = 2350$

Fraction working at Longridge: $\frac{700}{2350}$

Number in sample:

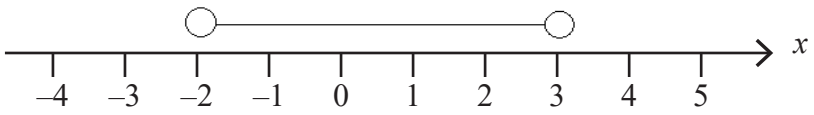
$\frac{700}{2350} \times 50 = 14.89$

Number in sample should be 15

.....15.....

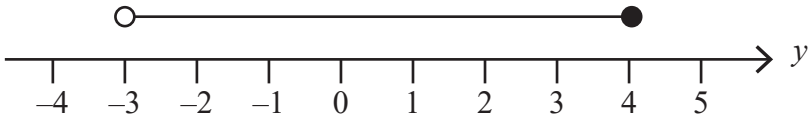
(Total for Question 14 is 2 marks)

15 (a) On the number line below, show the inequality $-2 < x < 3$



(1)

(b) Here is an inequality, in y, shown on a number line.



Write down the inequality.

$-3 < y \leq 4$

(2)

(c) Solve the inequality $4t - 5 > 9$

$4t > 9 + 5$

$4t > 14$

$t > \frac{14}{4}$

$t > 3.5$

3.5

(2)

(Total for Question 15 is 5 marks)

16

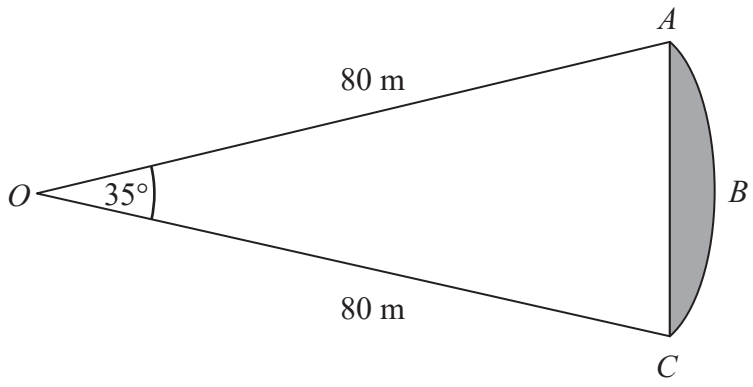


Diagram **NOT** accurately drawn

ABC is an arc of a circle centre *O* with radius 80 m.
AC is a chord of the circle.
Angle *AOC* = 35°.

Calculate the area of the shaded region.
Give your answer correct to 3 significant figures.

$$\text{Area of sector} = \frac{\Theta}{360}\pi r^2$$

$$= \frac{35}{360}\pi \times 80^2$$

$$= 1954.77$$

$$\text{Area of triangle} = \frac{1}{2} AO \times CO \sin 35°$$

$$= \frac{1}{2} \times 80 \times 80 \sin 35°$$

$$= 1835.44$$

Area of shaded segment:

$$1954.77 - 1835.44 = 119.33$$

.....119..... m^2

(Total for Question 16 is 5 marks)

17 The table below gives some information about some students in a school.

Year group	Boys	Girls	Total
Year 12	126	94	220
Year 13	77	85	162
Total	203	179	382

Andrew is going to carry out a survey of these students.
He uses a sample of 50 students, stratified by year group and gender.

Work out the number of Year 13 girls that should be in his sample.

Total number of students: 382

Proportion of Year 2 girls: $\frac{85}{382}$

Sample size: $\frac{85}{382} \times 50$

$= 11.125$

There would be 11 Year 13 girls.

.....11.....

(Total for Question 17 is 2 marks)

---

18 y is directly proportional to x.

When $x = 500$, $y = 10$

(a) Find a formula for y in terms of x.

$y \propto x$
$y = kx$
$10 = 500k$
$k = \frac{10}{500}$
$= \frac{1}{50}$

$y = \frac{1}{50} \times x$

$y = \frac{x}{50}$

$y =$ ..... $\frac{x}{50}$ .....

(3)

(b) Calculate the value of y when $x = 350$

$y = \frac{350}{50}$
$= 7$

$y =$ .....7.....

(1)

(Total for Question 18 is 4 marks)

19 A and B are vertices of a cuboid.

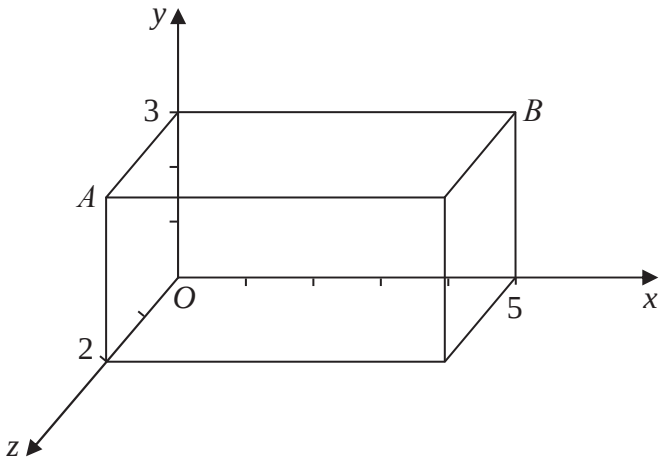


Diagram **NOT** accurately drawn

(a) Write down the coordinates of point A.

(....0.... , ...3.... , ...2....)

(1)

(b) Write down the coordinates of point B.

(....5.... , ...3.... , ...0....)

(1)

(Total for Question 19 is 2 marks)

---

20 (a) Write 83 500 000 in standard form.

.....8.35×10^7.....

.

(1)

(b) Work out $(5.2 \times 10^{-7}) \times (2.8 \times 10^{-9})$

Give your answer in standard form.

.....1.456×10^{-15}.....

(2)

(Total for Question 20 is 3 marks)

21 Katy invests £2000 in a savings account for 3 years.

The account pays compound interest at an annual rate of

2.5% for the first year

x% for the second year

x% for the third year

There is a total amount of £2124.46 in the savings account at the end of 3 years.

(a) Work out the rate of interest in the second year.

Year 1

$2000 \times 1.025 = 2050$

For both the next two years the interest rate was x%

Year 3

$2050 \times x^2 = 2124.46$

$$x^2 = \frac{2124.46}{2050}$$

$x = 1.01799$

$= 1.799\%$

or 1.8%

(4)

Katy goes to work by train.

The cost of her weekly train ticket increases by 12.5% to £225

(b) Work out the cost of her weekly train ticket before this increase.

$225 \div 1.125 = 200$

The cost was £200

(2)

(Total for Question 21 is 6 marks)

22 d is inversely proportional to c

When $c = 280$, $d = 25$

Find the value of d when $c = 350$

$$d \propto \frac{1}{c}$$

$$d = \frac{k}{c}$$

$$25 = \frac{k}{280}$$

$$k = 25 \times 280$$

$$k = 7000$$

When $c = 350$

$$d = \frac{7000}{350}$$

$$= 20$$

$d =$ 20

(Total for Question 22 is 3 marks)

---

23 Prove algebraically that

$(2n + 1)^2 - (2n + 1)$ is an even number

for all positive integer values of n.

$$(2n + 1)(2n + 1) - (2n + 1)$$

$$= 4n^2 + 2n + 2n + 1 - 2n - 1$$

$$= 4n^2 + 2n$$

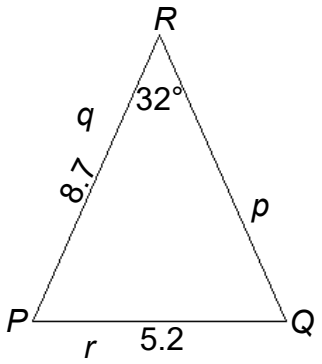
$$= 2(2n^2 + n)$$

Any positive integer value for n will be even as it is multiplied by 2.

(Total for Question 23 is 3 marks)

24 In triangle RPQ,

$RP = 8.7$ cm
$PQ = 5.2$ cm
Angle $PRQ = 32°$



(a) Assuming that angle PQR is an acute angle, calculate the area of triangle RPQ.
Give your answer correct to 3 significant figures.

To find the area we need two sides and the included angle.

Use the sine rule to find angle P

$$\frac{\sin Q}{8.7} = \frac{\sin 32°}{5.2}$$

$$\sin Q = \frac{8.7 \sin 32°}{5.2}$$

$$Q = 62.4485$$

$$\text{Angle } P = 180 - 32 - 62.45$$

$$= 85.55$$

$$\text{Area} = \frac{1}{2} q\, r \sin P \qquad \text{Two sides and the included angle.}$$

$$= \frac{1}{2} \times 8.7 \times 5.2 \sin 85.55°$$

$$= 22.55$$

22.6 cm^2

(4)

(b) If you did not know that angle PQR is an acute angle, what effect would this have on your calculation of the area of triangle RPQ?

PRQ could have been obtuse, so the areas of two triangles would have been calculated.

(1)

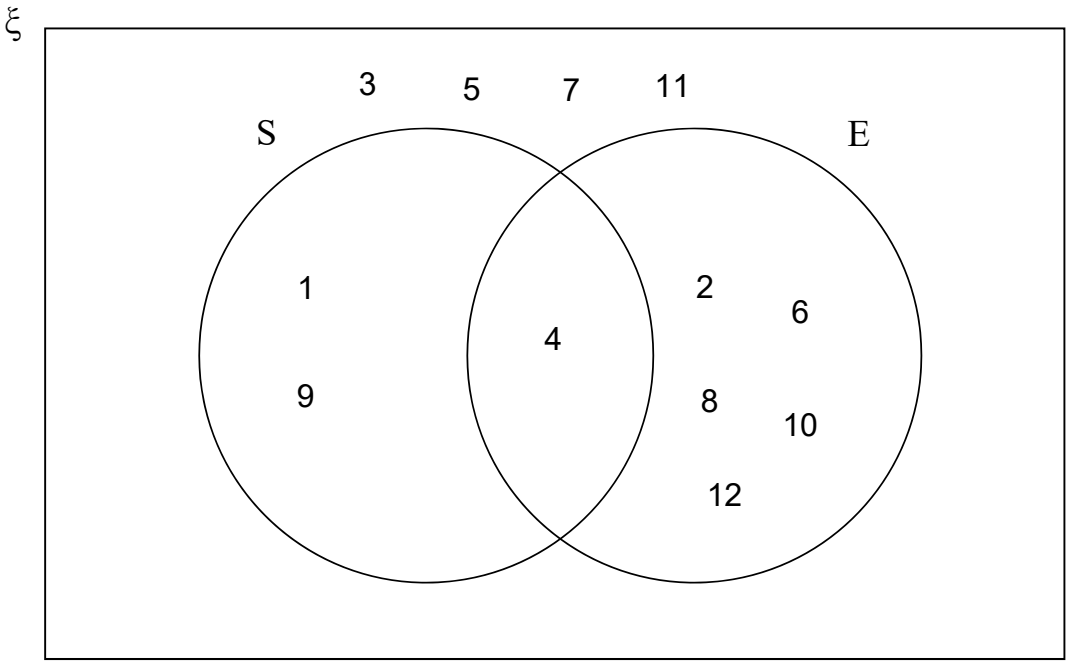
(Total for Question 24 is 5 marks)

25 $\xi = \{1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12\}$

S = square numbers

E = even numbers

6 (a) Complete the Venn diagram.



(3)

(b) One of the numbers is chosen at random.

Write down $P(S \cap E)$

Means the probability of picking a number from the intersection of S and E. Only one of the 12 numbers is in the intersection. $\frac{1}{12}$

(1)

(Total for Question 25 is 4 marks)

26 Written as the product of its prime factors

$672 = 2^5 \times 3 \times 7$

(a) Write 252 as the product of its prime factors.

2	252
2	126
3	63
3	21
7	7
	1

$2 \times 2 \times 3 \times 3 \times 7 = 252$

(2)

(b) Work out the value of the highest common factor of 672 and 252

$672 = 2^5 \times 3 \times 7$

$252 = 2^2 \times 3^2 \times 7$

$HCF = 2^2 \times 3 \times 7$ 84

(1)

(Total for Question 26 is 3 marks)

27 **(a)** Write $x^2 + 10x + 29$ in the form $(x + a)^2 + b$.

Completing the square

$(x + 5)^2 - 25 + 29$

$= (x + 5)^2 + 4$

(a) .....$(x + 5)^2 + 4$.....

(3)

(b) Write down the coordinates of the turning point of the graph of $y = x^2 + 10x + 29$.

$(x + 5)^2 + 4 = 0$

$(x + 5)^2$ is a square and so is always positive unless it is zero.

The lowest possible value for x is when $x + 5 = 0$

This is when $x = -5$

Subs $x = -5$ in $y = x^2 + 10x + 29$

$y = 25 - 50 + 29$

$y = 4$

(b) (.....–5..... , ...4.....)

(1)

(Total for Question 27 is 4 marks)