Write your name here

Surname	Other names

Pearson Edexcel
Level 1 / Level 2
GCSE (9–1)

Centre Number | Candidate Number

Mathematics

Paper 3 (Calculator)

Higher Tier

Tuesday 13 June 2017 – Morning
Time: 1 hour 30 minutes

Paper Reference
1MA1/3H

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

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.*
- You must **show all your working**.
- Diagrams are **NOT** accurately drawn, unless otherwise indicated.
- **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.

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 ▶

6/6/6/6/6/7/4/

Please note that these worked solutions have neither been provided nor approved by Pearson Education and may not necessarily constitute the only possible solutions. Please refer to the original mark schemes for full guidance.

Any writing in blue indicates what must be written in order to answer the questions and get the marks. The worked solutions have been designed to show the smallest amount of work which needs to be done to answer the question.

Anything written in green in a cloud doesn't have to be written in the exam.

Anything written in orange in a rectangle doesn't have to be written in the exam and is there to show what should be put into a calculator or measured using a ruler or protractor.

If you find any mistakes or have any requests or suggestions, please send an email to curtis@cgmaths.co.uk

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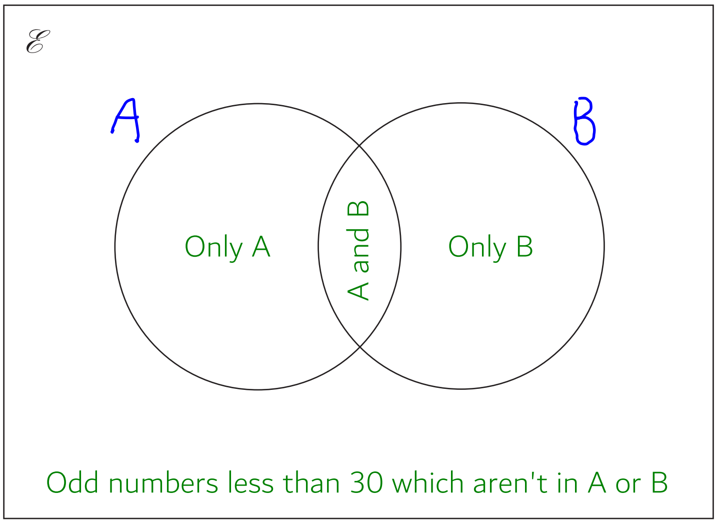
Answer ALL questions.

Write your answers in the spaces provided.

You must write down all the stages in your working.

1 $\mathscr{E}$ = {odd numbers less than 30}
A = {3, 9, 15, 21, 27}
B = {5, 15, 25}

(a) Complete the Venn diagram to represent this information.



(4)

A number is chosen at random from the universal set, $\mathscr{E}$.

(b) What is the probability that the number is in the set $A \cup B$?

$$\frac{\text{Numbers are in A or B or both}}{\text{Numbers in total}}$$

....

(2)

(Total for Question 1 is 6 marks)

2 Solve the simultaneous equations

$$3x + y = -4$$
$$3x - 4y = 6$$

Eliminate the x terms by subtracting the second equation away from the first equation. This will give an equation in terms of y which can be rearranged and solved. Once there is a solution for y, rearrange one of the equations to make x the subject and substitute in the value of y.

$x =$ ....

$y =$ ....

(Total for Question 2 is 3 marks)

3 The table shows some information about the dress sizes of 25 women.

Dress size	Number of women
8	2
10	9
12	8
14	6

(a) Find the median dress size.

$\frac{25+1}{2} = 13$

So the 13th value is the median.

....

(1)

3 of the 25 women have a shoe size of 7

Zoe says that if you choose at random one of the 25 women, the probability that she has either a shoe size of 7 or a dress size of 14 is $\frac{9}{25}$ because

$$\frac{3}{25} + \frac{6}{25} = \frac{9}{25}$$

(b) Is Zoe correct?
You must give a reason for your answer.

If 5/10 of people have a bike and 6/10 of people have a car, is the probability of picking someone who has a car 11/10?

....

(1)

(Total for Question 3 is 2 marks)

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4 Daniel bakes 420 cakes.
He bakes only vanilla cakes, banana cakes, lemon cakes and chocolate cakes.

$\frac{2}{7}$ of the cakes are vanilla cakes.

35% of the cakes are banana cakes.
The ratio of the number of lemon cakes to the number of chocolate cakes is 4 : 5

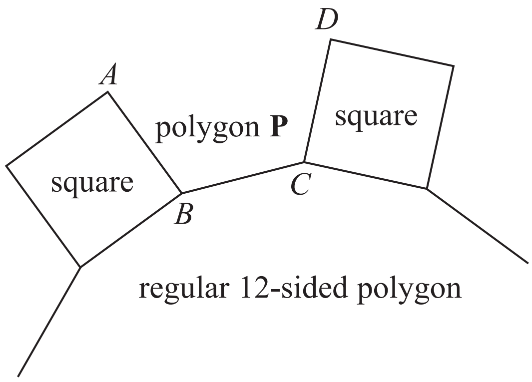
Work out the number of lemon cakes Daniel bakes.

Calculate how many vanilla then how many banana cakes there are. Subtracting these amounts from 420 gives how many lemon and chocolate cakes there are, which can then be divided into the ratio.

....

(Total for Question 4 is 5 marks)

5 In the diagram, *AB*, *BC* and *CD* are three sides of a regular polygon **P**.



Show that polygon **P** is a hexagon.
You must show your working.

Calculate the exterior angle of the regular 12-sided polygon using the formula 360/number of sides = exterior angle.

Calculate the interior angle of polygon P.

Show that the interior angle of a regular hexagon (6 sides) is the same as the calculated interior angle.
Interior angle = ((n - 2) x 180)/n, where n is the number of sides.

(Total for Question 5 is 4 marks)

6 The density of apple juice is 1.05 grams per cm^3.

The density of fruit syrup is 1.4 grams per cm^3.

The density of carbonated water is 0.99 grams per cm^3.

25 cm^3 of apple juice are mixed with 15 cm^3 of fruit syrup and 280 cm^3 of carbonated water to make a drink with a volume of 320 cm^3.

Work out the density of the drink.
Give your answer correct to 2 decimal places.

$d = \frac{m}{V}$

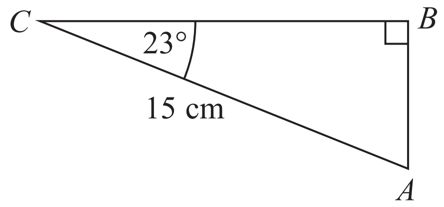
$m = dV$

To work out the density, d, we need to work out the total mass, m, and divide this by the total volume, v. To work out the total mass, we need to add the mass of each of the liquids together.

....g/cm^3

(Total for Question 6 is 4 marks)

7 *ABC* is a right-angled triangle.



Calculate the length of *AB*.
Give your answer correct to 3 significant figures.

S O H C A H T O A

List SOH CAH TOA as formula triangles and tick what we have and what we are trying to find. If there are two ticks on a formula triangle, that one can be used. Cover what we are trying to find and the formula triangle will tell us what to do.

....cm

(Total for Question 7 is 2 marks)

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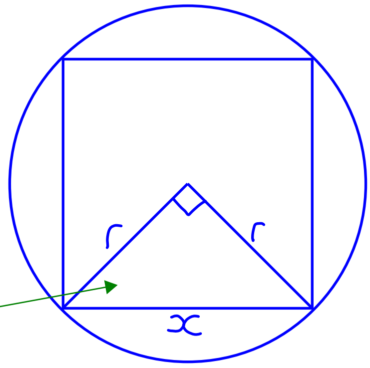
8 A square, with sides of length x cm, is inside a circle.
Each vertex of the square is on the circumference of the circle.

The area of the circle is 49 cm^2.

Work out the value of x.
Give your answer correct to 3 significant figures.

πr^2 = area of circle
This can be rearranged to find r

Side x and two radii make a right angled triangle so Pythagoras' Theorem can be used.



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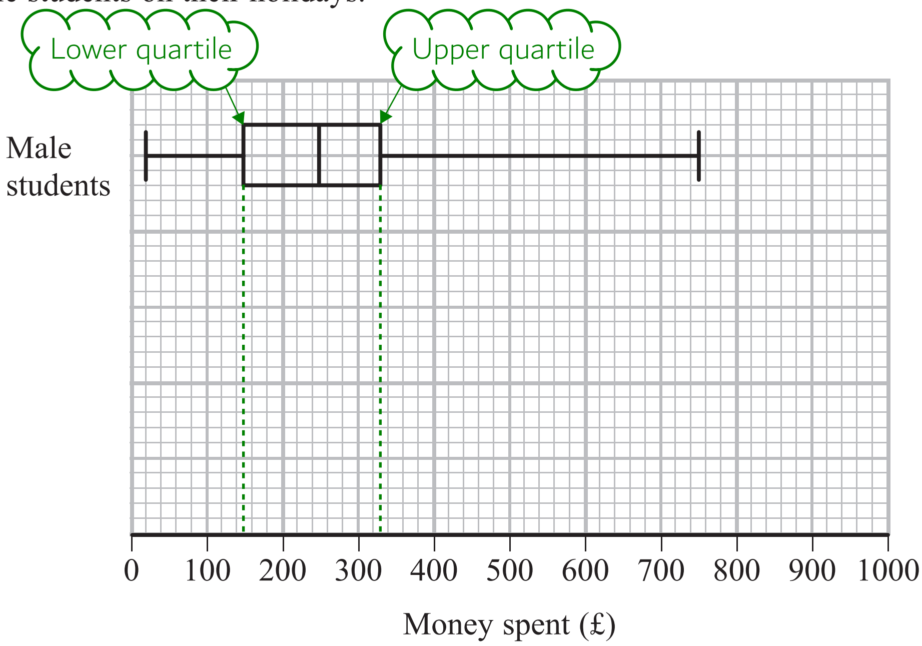
(Total for Question 8 is 4 marks)

9 The box plot shows information about the distribution of the amounts of money spent by some male students on their holidays.



(a) Work out the interquartile range for the amounts of money spent by these male students.

Interquartile range = upper quartile - lower quartile

£..

(2)

The table below shows information about the distribution of the amounts of money spent by some female students on their holidays.

	Smallest	Lower quartile	Median	Upper quartile	Largest
Money spent (£)	60	180	300	350	650

(b) On the grid above, draw a box plot for the information in the table.

(2)

Draw a vertical line for each of the values in the table above. Then draw a box between the quartiles and lines from the box to the smallest and largest value. The box plot should look like the one already drawn.

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Chris says,

"The box plots show that the female students spent more money than the male students."

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

Compare the medians to see which group spent the most on average

....

....

(1)

(Total for Question 9 is 5 marks)

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10 Naoby invests £6000 for 5 years.
The investment gets compound interest of x% per annum.

At the end of 5 years the investment is worth £8029.35

Work out the value of x.

Compound interest/decay: P changed by r% n times becomes $P(1 + r/100)^n$

$P = 8029.35$

$r = x$

$n = 5$

Substitute in the values and rearrange to make x the subject.

....

(Total for Question 10 is 3 marks)

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11 Jeff is choosing a shrub and a rose tree for his garden.
At the garden centre there are 17 different types of shrubs and some rose trees.

Jeff says,

"There are 215 different ways to choose one shrub and one rose tree."

Could Jeff be correct?
You must show how you get your answer.

Using the product rule for counting:
number of shrubs x number of rose trees = 215
Rearrange to find the number of rose trees.

(Total for Question 11 is 2 marks)

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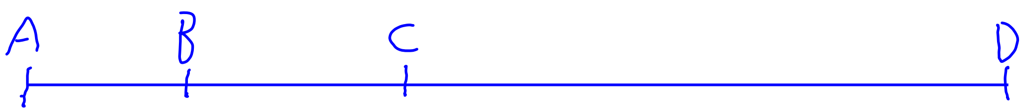
12 The points A, B, C and D lie in order on a straight line.

$$AB : BD = 1 : 5$$
$$AC : CD = 7 : 11$$

Both ratios are running from A to D but they have different number of parts so aren't compatible. Make both ratios have the same number of parts in total.

Work out $AB : BC : CD$

A rough sketch of the information we are given.

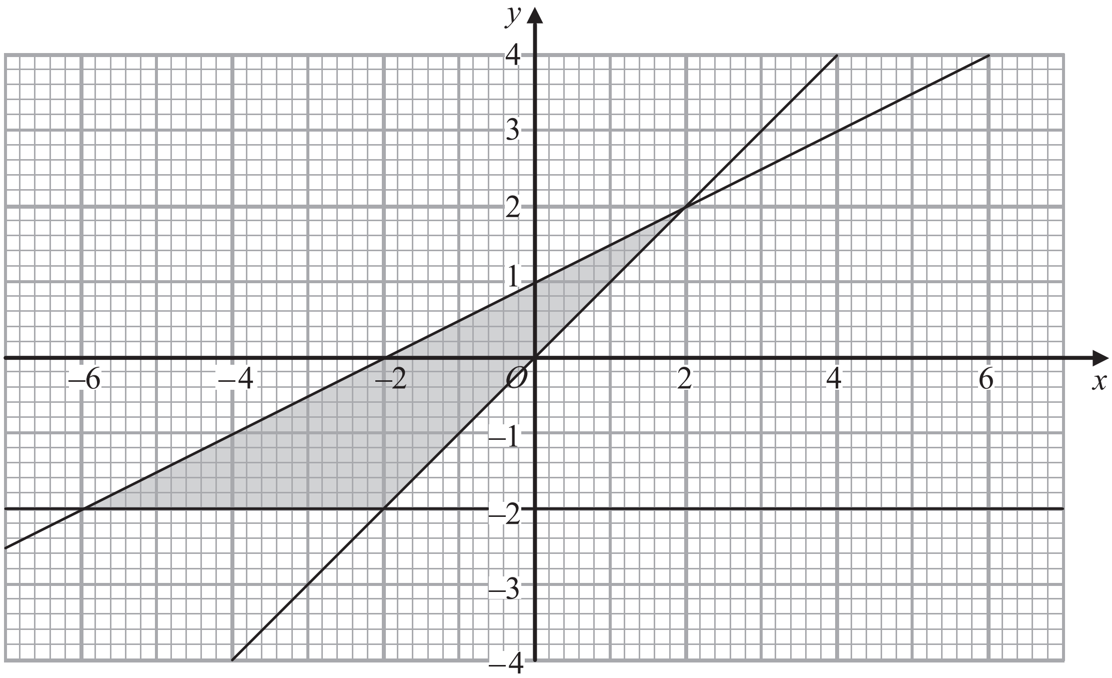


Write on the number of parts from the ratios above to work out how many parts represent BC.

.... : .... : ....

(Total for Question 12 is 3 marks)

13



Write down the three inequalities that define the shaded region.

Work out the equation of the lines then convert them into inequalities. They are all in the form $y = mx + c$ where m is the gradient and c is the y-intercept. Gradient = (change in y)/(change in x).

y is less if the region is below the line. y is greater if the region is above the line. It can be equal to the line if the line is solid. It can't be equal to the line if the line is dashed.

....

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....

(Total for Question 13 is 4 marks)

14 (a) Simplify $\dfrac{x^2 - 16}{2x^2 - 5x - 12}$

Factorise the numerator by difference of two squares.

Factorise the denominator. It is in the form $ax^2 + bx + c$. Multiply a by c. Split the middle x term into two numbers which multiply to get ac and add to -5. Factorise the first two terms and the last two terms then bring it together into a factorised form.

Cancel out any common factors between the numerator and denominator.

....

(3)

(b) Make v the subject of the formula $w = \dfrac{15(t - 2v)}{v}$

Eliminate v as a denominator and expand out the bracket. Bring all the terms involving v to the same side and everything else to the other side. Factorise and bring v out as a factor. Then divide by whatever is left in the bracket to make v the subject.

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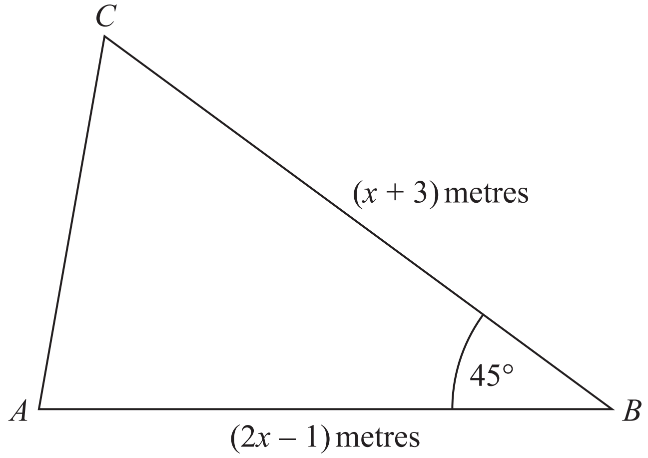
(3)

(Total for Question 14 is 6 marks)

15



The area of triangle ABC is $6\sqrt{2}$ m^2.

Calculate the value of x.
Give your answer correct to 3 significant figures.

1/2 x $ab\sin C$ = area of triangle

Substitute $(x + 3)$ for a, $(2x - 1)$ as b and 45 for C. Rearrange and simplify until there is a quadratic in the form $ax^2 + bx + c = 0$ which can be solved using the quadratic formula:
$x = (-b \pm\sqrt{b^2 - 4ac})/2a$

There will be two solutions however one of them should be disregarded as it cannot be a length.

....

(Total for Question 15 is 5 marks)

16 Using $x_{n+1} = -2 - \dfrac{4}{x_n^2}$

with $x_0 = -2.5$

(a) find the values of x_1, x_2 and x_3

$x_1 = -2 - \dfrac{4}{(x_0)^2}$

Substitute x_0 for x_n in the formula.

$x_2 = -2 - \dfrac{4}{(x_1)^2}$

Substitute x_1 for x_n in the formula.

$x_3 = -2 - \dfrac{4}{(x_2)^2}$

Substitute x_2 for x_n in the formula.

x_1 = ...

x_2 = ...

x_3 = ...

(3)

(b) Explain the relationship between the values of x_1, x_2 and x_3 and the equation $x^3 + 2x^2 + 4 = 0$

Iterative formulas are set up to find approximate solutions.

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(2)

(Total for Question 16 is 5 marks)

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17 A train travelled along a track in 110 minutes, correct to the nearest 5 minutes.

Jake finds out that the track is 270 km long.
He assumes that the track has been measured correct to the nearest 10 km.

(a) Could the average speed of the train have been greater than 160 km/h?
You must show how you get your answer.

$s = \frac{d}{t}$

To get the fastest possible speed, we need to consider whether to use the upper or lower bound for each measurement.

To find the bounds, add and subtract half of the resolution.

Convert the minutes into hours.

(4)

Jake's assumption was wrong.
The track was measured correct to the nearest 5 km.

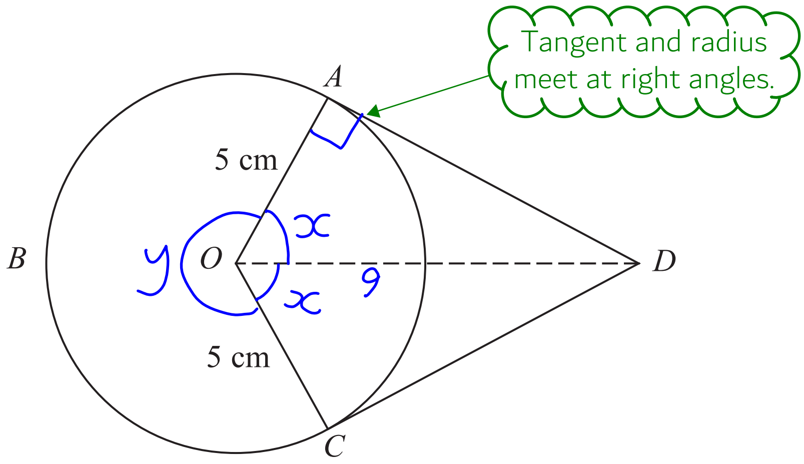
(b) Explain how this could affect your decision in part (a).

The distance would be less. Without recalculating, would this effect the decision?

(1)

(Total for Question 17 is 5 marks)

18



A, B and C are points on a circle of radius 5 cm, centre O.
DA and DC are tangents to the circle.
$DO = 9$ cm

Work out the length of arc ABC.
Give your answer correct to 3 significant figures.

Arc ABC is a fraction of the circumference, which can be found with π x diameter. The diameter is double the radius.

To find the fraction of the circumference, we need to find angle y and to find this we need angle x, which is in a right angled triangle and can be found using trigonometry.

.... cm

(Total for Question 18 is 5 marks)

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19 Solve $2x^2 + 3x - 2 > 0$

Factorise the left side then set it equal to 0 so it can be solved. It is in the form $ax^2 + bx + c$. Multiply a by c. Split the middle x term into two numbers which multiply to get ac and add to 3. Factorise the first two terms and the last two terms then bring it together into a factorised form. Either the first bracket is equal to 0 or the second bracket is equal to 0. Rearrange both of these equations to solve x.

To work out the solutions to the inequality, consider what the graph would look like and which values of x give values greater than 0.

....

(Total for Question 19 is 3 marks)

20 The equation of a curve is $y = a^x$
A is the point where the curve intersects the y-axis.

(a) State the coordinates of A.

The x-coordinate is ? at the y-axis.
Substituting x for ? gives $y = a^?$.
Anything to the power of ? is ?.

(.......................... , ...)
(1)

The equation of circle **C** is $x^2 + y^2 = 16$

The circle **C** is translated by the vector $\begin{pmatrix} 3 \\ 0 \end{pmatrix}$ to give circle **B**.

(b) Draw a sketch of circle **B**.

Label with coordinates
the centre of circle **B**
and any points of intersection with the x-axis.

The equation of a circle is
$(x - h)^2 + (y - k)^2 = r^2$
centre is (h , k) and r is radius.
So the centre was at (? , ?) and the
radius is ?. The circle is translated 3
in the x-direction.

(3)

(Total for Question 20 is 4 marks)

TOTAL FOR PAPER IS 80 MARKS