Surname	Centre Number	Candidate Number
Other Names		0

GCSE

C300UA0-1

S19-C300UA0-1

MATHEMATICS – Component 1
Non-Calculator Mathematics
HIGHER TIER

TUESDAY, 21 MAY 2019

– MORNING

2 hours 15 minutes

ADDITIONAL MATERIALS

The use of a calculator is not permitted in this examination.

A ruler, protractor and a pair of compasses may be required.

INSTRUCTIONS TO CANDIDATES

Use black ink or black ball-point pen.

You may use a pencil for graphs and diagrams only.

Write your name, centre number and candidate number in the spaces at the top of this page.

Answer **all** the questions in the spaces provided.

If you run out of space, use the continuation page at the back of the booklet, taking care to number the question(s) correctly.

INFORMATION FOR CANDIDATES

You should give details of your method of solution when appropriate.

Unless stated, diagrams are not drawn to scale.

Scale drawing solutions will not be acceptable where you are asked to calculate.

The number of marks is given in brackets at the end of each question or part-question.

You are reminded of the need for good English and orderly, clear presentation in your answers.

For Examiner's use only		
Question	**Maximum Mark**	**Mark Awarded**
1.	**2**	
2.	**8**	
3.	**5**	
4.	**6**	
5.	**5**	
6.	**7**	
7.	**2**	
8.	**3**	
9.	**3**	
10.	**7**	
11.	**5**	
12.	**9**	
13.	**8**	
14.	**6**	
15.	**3**	
16.	**3**	
17.	**8**	
18.	**5**	
19.	**7**	
20.	**6**	
21.	**7**	
22.	**5**	
Total	**120**	

C300UA01
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Formula list

Area and volume formulae

Where r is the radius of the sphere or cone, l is the slant height of a cone and h is the perpendicular height of a cone:

Curved surface area of a cone = πrl

Surface area of a sphere = $4\pi r^2$

Volume of a sphere = $\frac{4}{3}\pi r^3$

Volume of a cone = $\frac{1}{3}\pi r^2 h$

Kinematics formulae

Where a is constant acceleration, u is initial velocity, v is final velocity, s is displacement from the position when $t = 0$ and t is time taken:

$$v = u + at$$

$$s = ut + \frac{1}{2}at^2$$

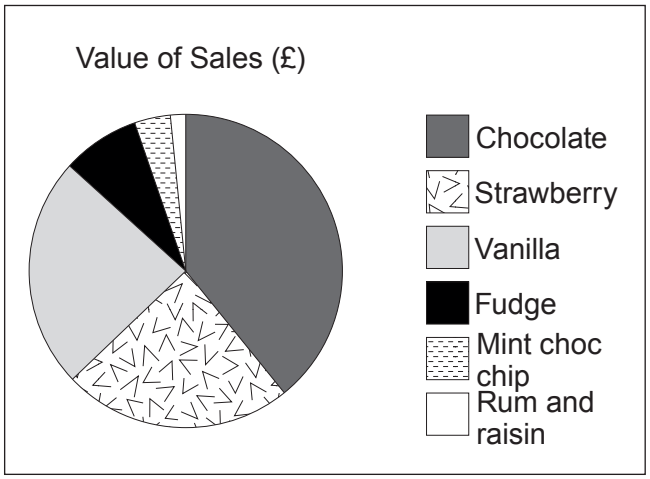
$$v^2 = u^2 + 2as$$

Examiner only

1. Cherie is in charge of marketing for a tourist attraction.

(a) One weekend, she collects some data about the value of ice cream sales from the café. She records her data in a table and uses it to draw a pie chart.

Ice cream flavour	Value of sales (£)
Chocolate	500
Strawberry	300
Coffee	0
Vanilla	300
Fudge	100
Green tea	0
Mint choc chip	50
Rum and raisin	20



State one criticism of the use of a pie chart to display her data. [1]

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C300UA01 03

(b) Cherie also records the number of visitors to the tourist attraction each season for 4 years.
Her results are shown in the table.

	Season	Winter	Spring	Summer	Autumn
Visitors (thousands)	2015	9	14	19	13
	2016	9	13	17	12
	2017	6	11	14	9
	2018	4	8	15	10

Comment on the trend in the **annual** number of visitors shown by the data in the table. [1]

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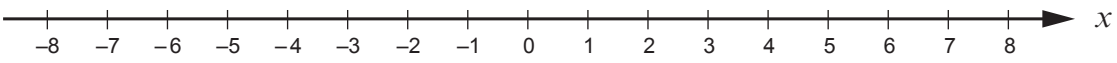
Examiner only

2. *(a)* Solve $19 - 4x = 11$. [2]

(b) Solve $\frac{2x-3}{4} = 3x$. [3]

(c) (i) Solve $3x + 2 > 5$. [2]

(ii) Represent your answer to part *(c)*(i) on the number line below. [1]



Examiner only

3. Huw is paid a weekly wage.

Every week he:

- saves $\frac{1}{5}$ of his wage,
- spends 70% of the money **he has left** on his living expenses,
- spends all that remains on his social life.

(a) One week, Huw saves £40.

How much does Huw spend on his social life? [3]

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(b) What percentage of his weekly wage does Huw spend on his social life? [2]

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Examiner only

4. *(a)* $120 = 2^3 \times 3^k \times 5$

Find the value of k. [1]

(b) Write 168 as a product of its prime factors. [2]

(c) *LoWatts Ltd* makes light bulbs that are identical in size.

They have regular orders from *Company A* for 120 light bulbs and from *Company B* for 168 light bulbs.

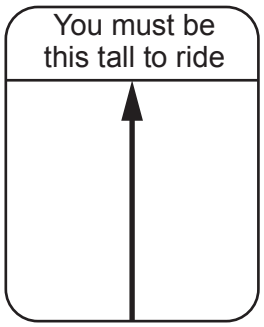
LoWatts Ltd uses one size of box to supply both *Company A* and *Company B*.
Each box used contains the same number of light bulbs and is full.
The number of boxes used is as few as possible.

How many light bulbs does each box hold? [3]

Examiner only

5. When Jenna was measured recently she was 127 cm tall, **correct to the nearest centimetre**.

For safety reasons, the minimum height for a person to ride the Big Coaster at a funfair in the USA is 50 inches.



You are given:
20 inches = 50·8 cm.

(a) Using the information given, decide whether it might possibly be safe, it is definitely safe, or it is definitely not safe for Jenna to ride the Big Coaster.

Might possibly be safe ☐ Definitely safe ☐ Definitely not safe ☐

Show how you decide. [3]

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(b) (i) State an assumption that you have made in your answer to part *(a)*. [1]

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(ii) Comment on the effect that your assumption has had on your decision. [1]

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Examiner only

6. The table shows some of the values of $y = x^2 + x - 1$ for $-2 \leqslant x \leqslant 1$.

x	–2	–1	–0·5	0	1
$y = x^2 + x - 1$		–1	–1·25		

(a) Complete the table above. [2]

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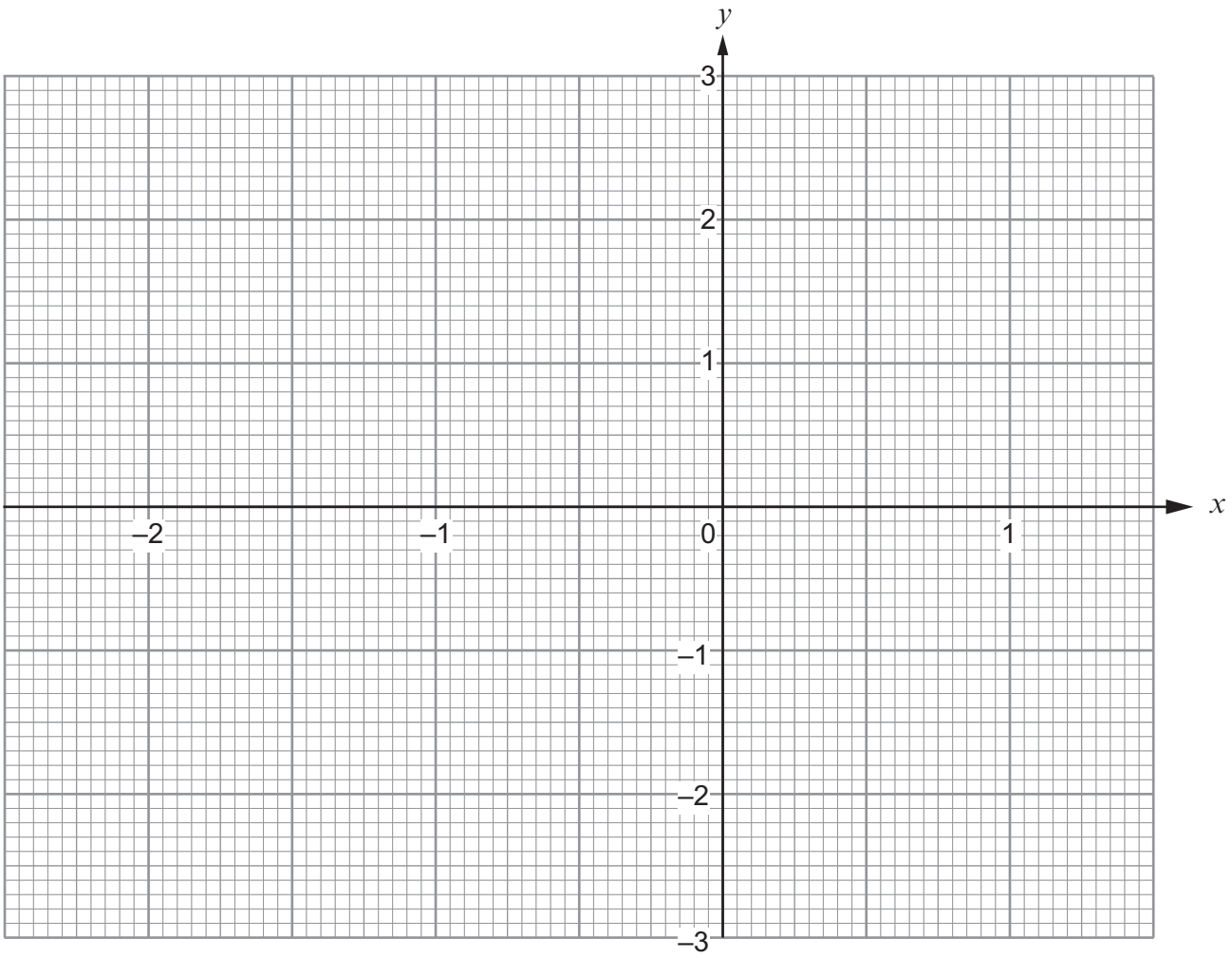
(b) On the graph paper below, draw the graph of $y = x^2 + x - 1$ for $-2 \leqslant x \leqslant 1$. [2]



(c) State the equation of the line of symmetry of the curve $y = x^2 + x - 1$. [1]

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(d) Use your graph to solve $x^2 + x - 1 = 0$. [2]

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Examiner only

7.

$$\mathbf{p} = \begin{pmatrix} 4 \\ 2 \end{pmatrix} \text{ and } \mathbf{q} = \begin{pmatrix} -3 \\ 2 \end{pmatrix}$$

Work out the column vector $\frac{1}{2}\mathbf{p} - \mathbf{q}$. [2]

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$$\frac{1}{2}\mathbf{p} - \mathbf{q} = \begin{pmatrix} \quad \\ \quad \end{pmatrix}$$

8. Jon bought a car.
The price of Jon's car had been reduced by 20%.
Jon paid £7680 for his car.

What was the price of the car before the reduction? [3]

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Examiner only

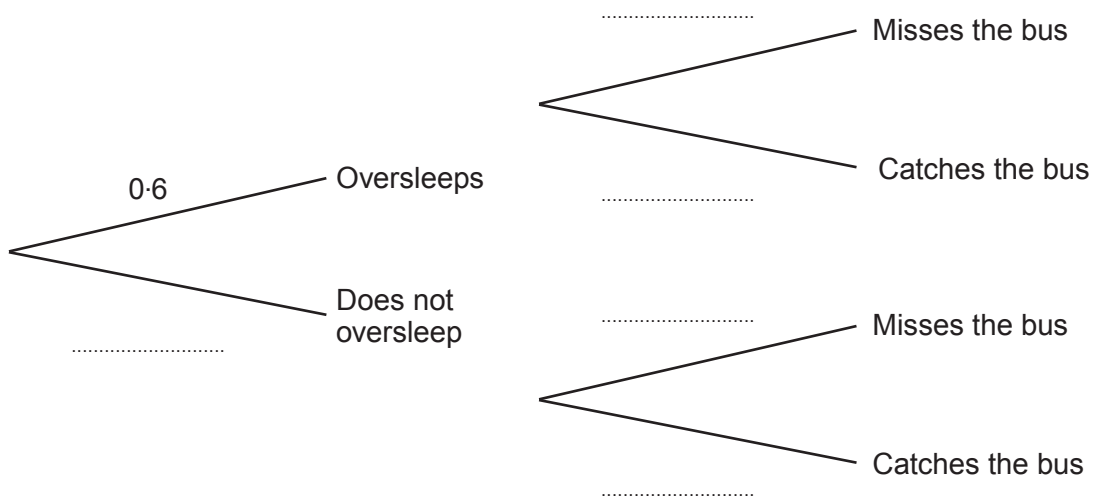
9. Rearrange $6(x + y) = 8x - 5$ to make x the subject. [3]

Examiner only

10. Sam needs to catch the 8 a.m. bus to get to work on time.
The probability that Sam oversleeps is 0·6.

When Sam oversleeps, the probability that he misses the bus is 0·8.
When Sam does not oversleep, the probability that he misses the bus is 0·3.

(a) Complete the following tree diagram to show this information. [2]



(b) Calculate the probability that Sam oversleeps and misses the bus. [2]

(c) Calculate the probability that Sam catches the bus.
You must show all your working. [3]

Examiner only

11. *(a)* Find the value of $(3 \times 10^{17}) \times (8 \times 10^{9})$.
Give your answer in standard form. [2]

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(b) In a particular country for one year:

- the total energy consumption was $5{\cdot}4 \times 10^{11}$ kilowatt hours,
- the average energy consumption per person was 6000 kilowatt hours.

Work out the population of the country.
Give your answer in standard form. [3]

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Examiner only

12. *(a)* Find the value of each of the following.

(i) $0{\cdot}8^{-1}$ [1]

(ii) $625^{\frac{1}{4}}$ [1]

(iii) $\left(\frac{1}{64}\right)^{\frac{2}{3}}$ [2]

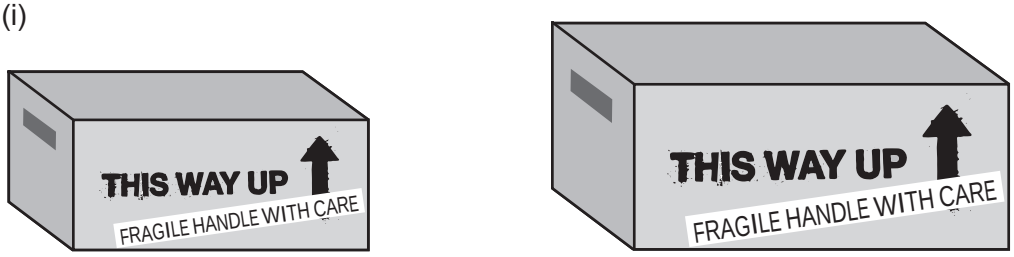
(b) Write $81\times\frac{3^0}{27^2}$ as a power of 3. [2]

(c) Simplify $\frac{\left(5ab^4\right)^3}{a^2}$. [3]

Examiner only

13. *(a)* Shabana is moving to a new house and is using boxes to pack.

(i)



Shabana has two mathematically similar packing boxes and says,

"The ratio of the lengths of two of my boxes is 2 : 3 so the ratio of their volumes must be 4 : 9."

Give a reason why Shabana is incorrect and state the correct ratio of the volumes. [2]

Reason .....

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Correct ratio ..... : .....

(ii)

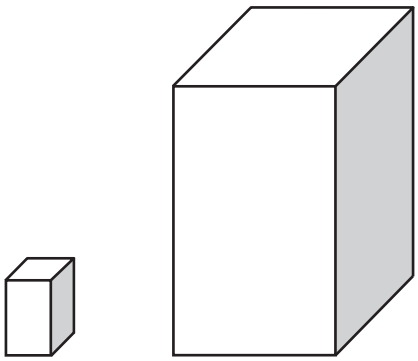

Diagram not drawn to scale

Shabana has two different square-based boxes where:

- the ratio of the lengths of the sides of the squares is 1 : 3,
- the ratio of their heights is 1 : 4.

How many of the small boxes can the large box hold? [2]

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Examiner only

(b) Shabana's new house is further away from her workplace.
She estimates that there will be a 15% increase in the cost of getting to work.

From her old house, she:

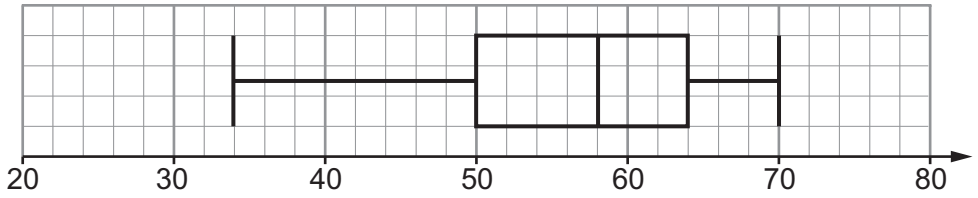
- drove 945 miles per month,
- used petrol at the rate of 9 miles per litre,
- paid 120p per litre for petrol.

How much **more** will it cost her to get to work each month **after** she has moved? [4]

Increased cost of getting to work £ .....

Examiner only

14. A garden centre sells fish.
This box plot summarises data about the length, in cm, of a sample of 50 black and white Japanese koi they have for sale.



Black and white koi length (cm)

(a) What is the length of the longest black and white koi? [1]

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(b) What is the median length of the black and white koi? [1]

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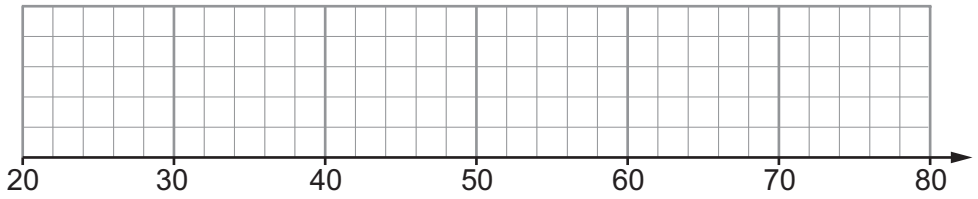
(c) The garden centre also sells red and white Japanese koi.
The table shows information about the length, in cm, of a sample of 50 of the red and white koi they have for sale.

Minimum	Maximum	Lower Quartile	Median	Interquartile range
26	72	42	46	20

Draw a box plot to represent this data on the grid below. [3]



Red and white koi length (cm)

(d) The garden centre calls its koi 'mature' if they are more than 48 cm in length.
Which of the two samples of fish contains more 'mature' koi?

Black and white ☐ Red and white ☐

Explain how you decide. [1]

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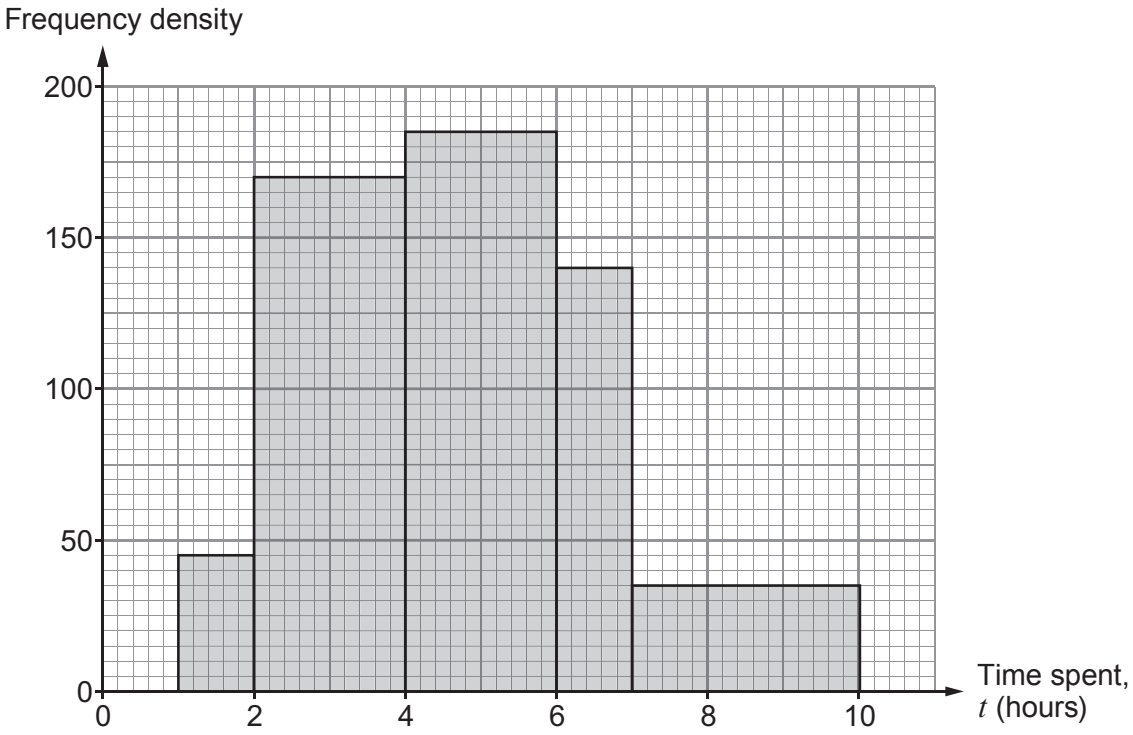
Examiner only

15. The histogram summarises the time spent by 1000 visitors at a flower show.



Calculate the percentage of visitors who spent 6 or more hours at the flower show. [3]

Examiner only

16.

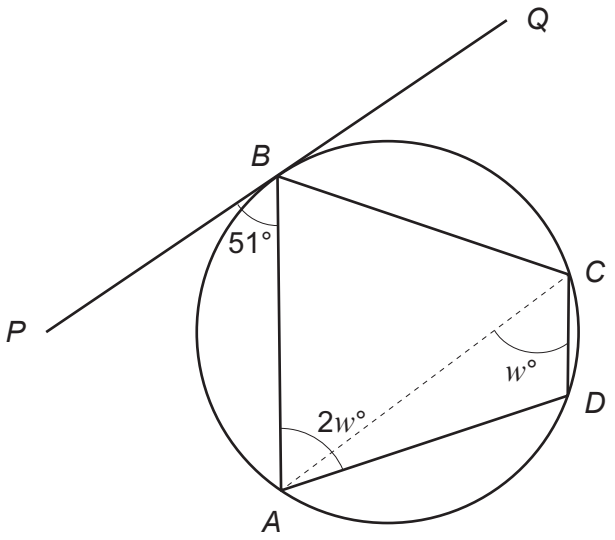


Diagram not drawn to scale

A, *B*, *C* and *D* are points on a circle.
The line *PQ* is a tangent to the circle at *B*.

$P\hat{B}A = 51°$, $A\hat{C}D = w°$ and $B\hat{A}D = 2w°$.

Find the value of w.
You must show all your working. [3]

w = ...

Examiner only

17. *(a)* Show that $\frac{\sqrt{63}}{\sqrt{7}} + \sqrt{147} + \sqrt{48}$ can be written in the form $a + b\sqrt{3}$, where a and b are integers. [3]

(b)

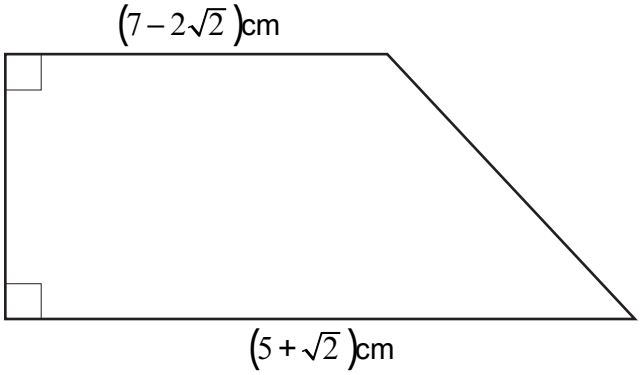


Diagram not drawn to scale

The area of this trapezium is $(6\sqrt{2} - 1)\text{cm}^2$.

Find the height of the trapezium.
Give your answer in its simplest form. [5]

Examiner only

18. Ravi needs to choose a 5-character passcode for a door lock.

He chooses to use 5 of these 7 characters:

1 9 6 7 R P #

Each chosen character is used only once.

(a) Find the number of different 5-character passcodes Ravi can make. [2]

(b) Find the probability that Ravi's 5-character passcode starts with R and ends with P. [3]

Examiner only

19. The functions $f(x)$ and $g(x)$ are defined for $x > 0$ by

$$f(x) = \frac{8}{x},$$
$$g(x) = x + 5.$$

(a) Find and simplify an expression for $ff(x)$. [2]

(b) Using your answer to part *(a)*, or otherwise, explain the relationship between $f(x)$ and $f^{-1}(x)$. [1]

(c) Solve $g^{-1}f(x) = 11$. [4]

Examiner only

20. Paula is baking biscuits for a charity fundraiser.
She makes biscuits in batches of 12.

Paula's weighing scales are accurate **to the nearest gram**.
She needs to weigh 8 grams of baking powder to make 12 biscuits.

She has 220 grams of baking powder, **correct to the nearest 10 grams**.
She has plenty of all the other ingredients she needs.

She plans to sell her biscuits at £2 for a pack of 3.

What is the greatest amount of money that Paula could raise for her charity?
You must show all your working. [6]

Examiner only

21.

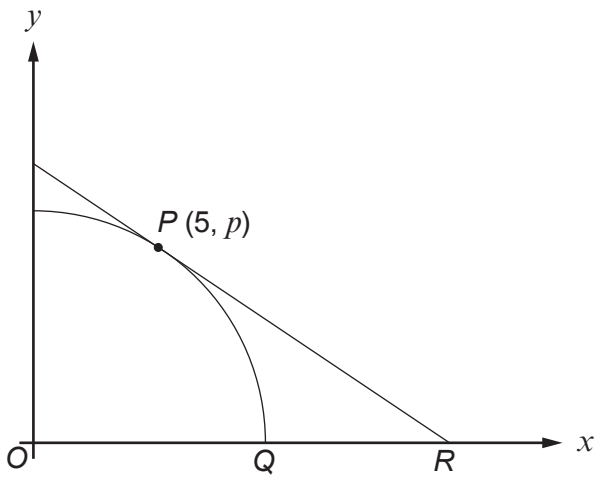


Diagram not drawn to scale

The diagram shows an arc of a circle with centre *O* and equation $x^2 + y^2 = 50$.
P (5, p) lies on the circle.
The arc meets the x-axis at *Q*.
The tangent to the circle at *P* meets the x-axis at *R*.

(a) Find the value of p, the y-coordinate of *P*. [1]

(b) Show that the equation of the tangent to the circle at *P* is $y = mx + 10$, where m is a constant. [4]

(c) Find the exact length of *QR*. [2]

Examiner only

22.

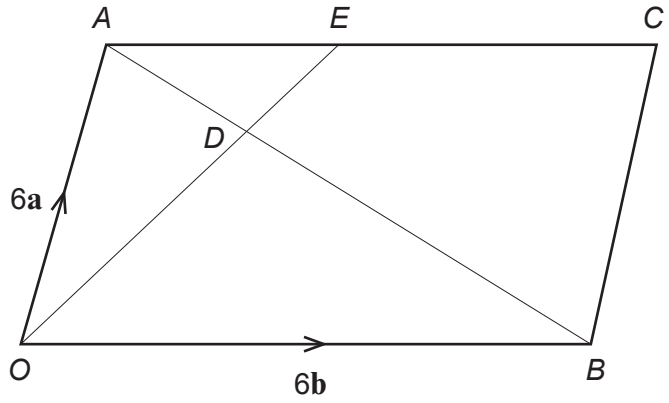


Diagram not drawn to scale

The diagram shows a parallelogram, *OACB*, and the vectors **OA** and **OB**.
E lies on *AC*.

D is the point of intersection of *OE* and *AB* so that $\mathbf{AD} = \frac{1}{3}\mathbf{AB}$.

(a) Complete this proof to show that $\mathbf{OE} = 6\mathbf{a} + 3\mathbf{b}$. [4]

Proof:

$\mathbf{OE} = \mathbf{OA} + \mathbf{AE} = 6\mathbf{a} + k\mathbf{b}$ for some positive scalar k

$\mathbf{OE} = n\mathbf{OD}$, for some positive scalar n

OD = ...

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(b) What does the proof in part *(a)* also tell you about the point *E*? [1]

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END OF PAPER

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For continuation only.

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