Surname	Centre Number	Candidate Number
Other Names		0

GCSE

3300U60-1

S18-3300U60-1

MATHEMATICS
UNIT 2: CALCULATOR-ALLOWED
HIGHER TIER

THURSDAY, 7 JUNE 2018 – MORNING

1 hour 45 minutes

For Examiner's use only		
Question	**Maximum Mark**	**Mark Awarded**
1.	4	
2.	3	
3.	6	
4.	4	
5.	3	
6.	5	
7.	6	
8.	5	
9.	6	
10.	2	
11.	3	
12.	4	
13.	3	
14.	2	
15.	4	
16.	4	
17.	5	
18.	4	
19.	7	
Total	**80**	

ADDITIONAL MATERIALS

A calculator will be required for this paper.

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

INSTRUCTIONS TO CANDIDATES

Use black ink or black ball-point pen. Do not use gel pen or correction fluid.

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. Question numbers must be given for all work written on the continuation page.

Take π as 3·14 or use the π button on your calculator.

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.

In question **3**, the assessment will take into account the quality of your linguistic and mathematical organisation, communication and accuracy in writing.

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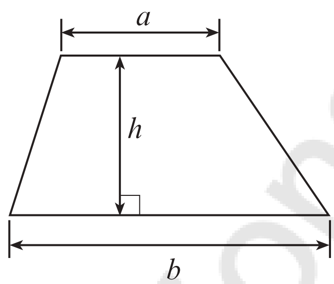
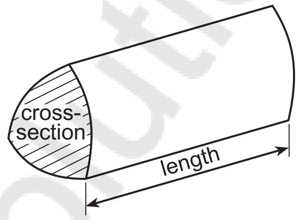
Formula List - Higher Tier

Area of trapezium = $\frac{1}{2}(a + b)h$

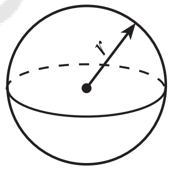


Volume of prism = area of cross-section × length



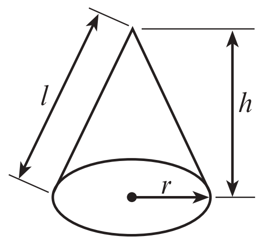
Volume of sphere = $\frac{4}{3}\pi r^3$

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



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

Curved surface area of cone = $\pi r l$

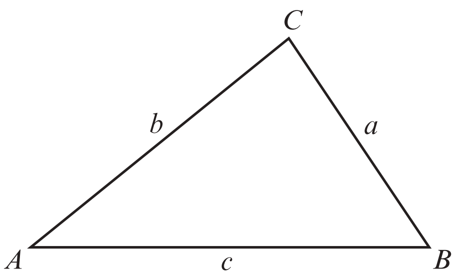


In any triangle ABC

Sine rule $\frac{a}{\sin A} = \frac{b}{\sin B} = \frac{c}{\sin C}$

Cosine rule $a^2 = b^2 + c^2 - 2bc \cos A$

Area of triangle = $\frac{1}{2}ab \sin C$



The Quadratic Equation

The solutions of $ax^2 + bx + c = 0$ where $a \neq 0$ are given by $x = \frac{-b \pm \sqrt{(b^2 - 4ac)}}{2a}$

Annual Equivalent Rate (AER)

AER, as a decimal, is calculated using the formula $\left(1 + \frac{i}{n}\right)^n - 1$, where i is the nominal interest rate per annum as a decimal and n is the number of compounding periods per annum.

Examiner only

1. *(a)* Calculate $\frac{145 \cdot 3}{(12 \cdot 4 - 9 \cdot 8)^3}$, giving your answer correct to 3 significant figures. [2]

$$\frac{145.3}{(12.4 - 9.8)^3} = \frac{145.3}{2.6^3} = 8.27$$

(b) Calculate the reciprocal of 47, giving your answer correct to 4 decimal places. [2]

$$\frac{1}{47} = 0.0213$$

2. Circle the correct answer in each of the following.

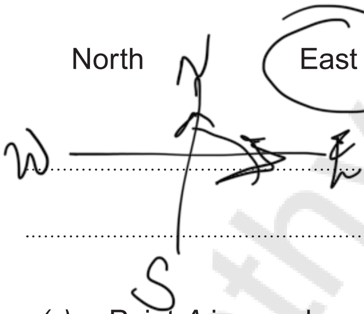
(a) Which of the following values **cannot** be an external angle of a regular polygon? [1]

10° 18° 30° 48° 72°

48° does not meet to be an external angle of a regular polygon

(b) An arrow on a spinner is facing north.
It is turned clockwise through an angle of 1530°.
In which direction will the arrow now be facing? [1]

North East South West None of these



(c) Point *A* is on a bearing of 100° from point *B*.
What is the bearing of point *B* from point *A*? [1]

260° 100° 280° 180° 80°

Add 180° to 100
= 280°

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 (3300U60-1) **Turn over.**

Examiner only

3. *In this question, you will be assessed on the quality of your organisation, communication and accuracy in writing.*

A solution of the equation

$$x^3 - 7x - 51 = 0$$

lies between 4 and 5.

Use the method of trial and improvement to find this solution correct to 1 decimal place.
You must show all your working. [4 + 2 OCW]

So we are going to try different values of x.

$\Rightarrow x^3 - 7x = 51$

Try 4.1 $= (4.1)^3 - 7(4.1) = 40.22 \neq 51$
Try 4.2 $= (4.2)^3 - 7(4.2) = 44.67 \neq 51$
Try 4.3 $= (4.3)^3 - 7(4.3) = 49.407$ (It's close)
Try 4.4 $= (4.4)^3 - 7(4.4) = 54.384$ (More than 51)

$\therefore 4.3 < x < 4.4$

Another correct evaluation :-

$\Rightarrow 4.3 \leq x \leq 4.35$

Correct to 1 decimal

$= 4.3$

 (3300U60-1)

Examiner only

4. *(a)* The highest common factor (HCF) of 30 and 75 is the square root of a number.
What is the number? [2]

HCF ~~of 30~~ ~~&~~ 75

$$5 \,|\, 30, 75$$
$$3 \,|\, 6, 15$$
$$2, 5$$

HCF = 15

$15^2 = 225$

$\therefore$ the no = 225

(b) The cube root of 32·768 is $33\frac{1}{3}$% of a number.
What is the number? [2]

$\sqrt[3]{32{\cdot}768} = \sqrt[3]{\frac{4096}{125}} = \frac{16}{5}$

$33\frac{1}{3}$% of the no $= \frac{100}{3}$% of the no $= \frac{16}{5}$

So, $\frac{\cancel{100}}{3} \times \frac{1}{\cancel{100}} \times$ The no $= \frac{16}{5}$

$\frac{\text{The no}}{3} = \frac{16}{5}$

The no $= \frac{16 \times 3}{5} = \frac{48}{5} = 9{\cdot}6$

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Examiner only

5. *PQR* is a right-angled triangle, as shown below.
PQ = 1·41 m and *PR* = 0·89 m.

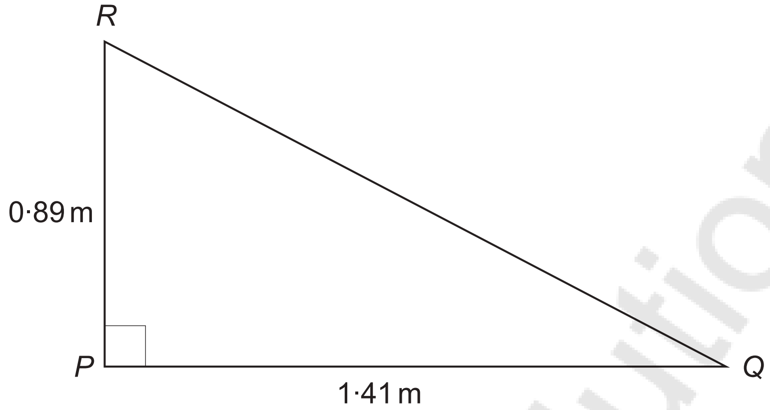


Diagram not drawn to scale

Calculate the length of *QR*. [3]

Using The pythagoras Theorem

$QR^2 = PR^2 + PQ^2$

$= (0\cdot 89)^2 + (1\cdot 41)^2$

$= 2\cdot 7802$

$QR = \sqrt{2\cdot 7802}$

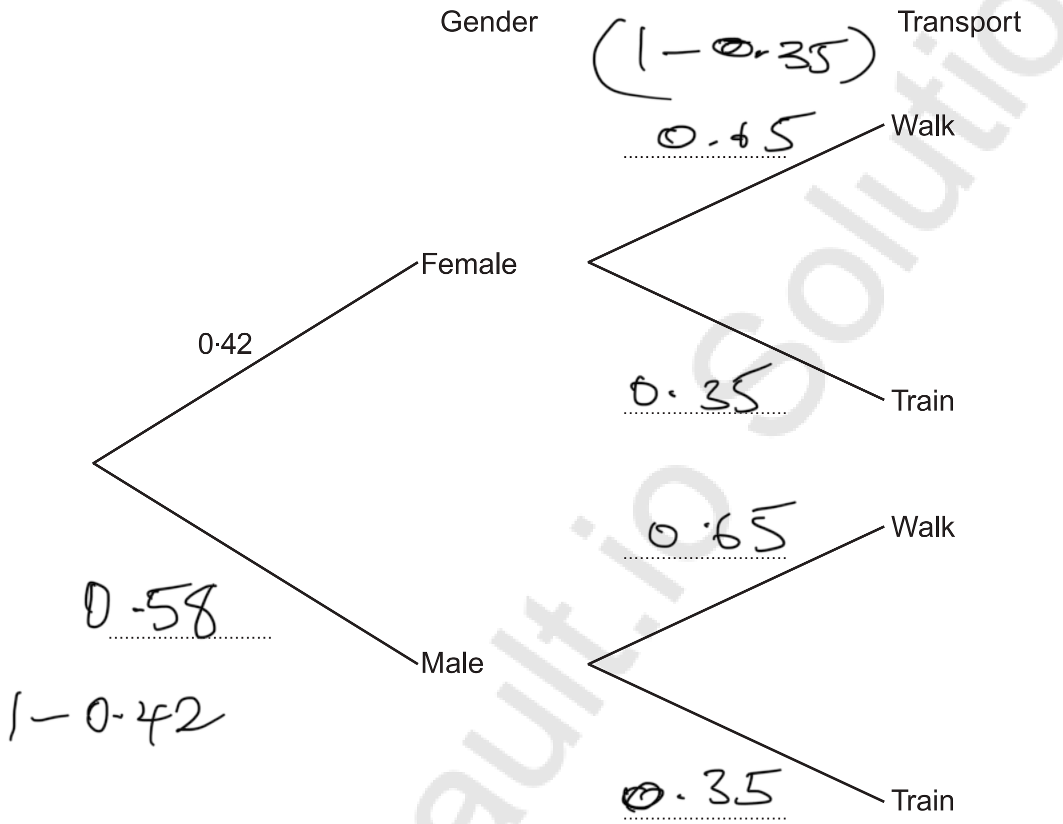
$= 1\cdot 67\text{m}$

Examiner only

6. Visitors to the top of Snowdon can either walk up the mountain or take the mountain railway from Llanberis.
On a particular day, a visitor to the top of Snowdon is chosen at random.
The probability that this person is female is 0·42.
The probability that this person took the train is 0·35.

The decision to walk or take the train is independent of gender.

(a) Complete the tree diagram shown below. [3]



(b) The person chosen at random receives a gift voucher.
What is the probability that this person is female and travelled up the mountain by train? [2]

P that the person is female
= 0.42
P that they used train = 0.35
So 0.42 × 0.35 = 0.147

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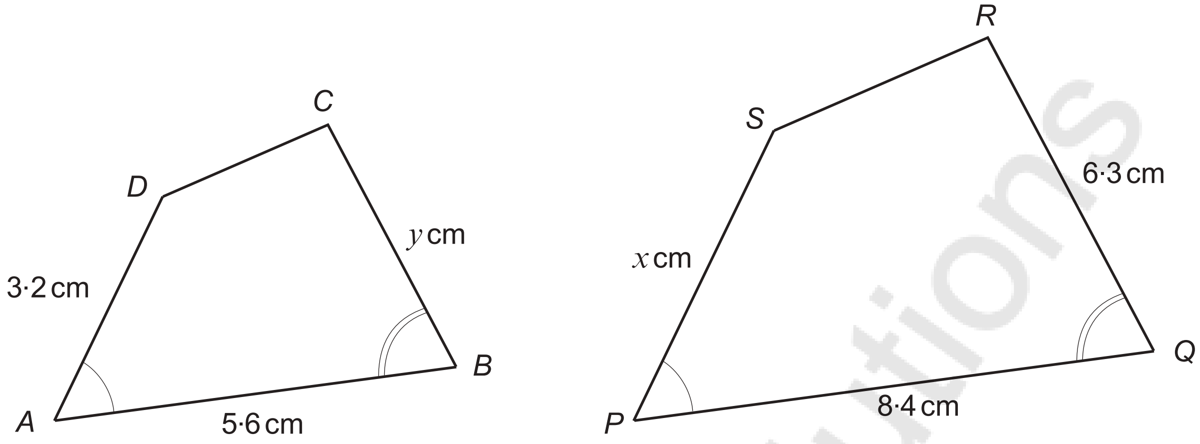
Turn over.

Examiner only

7. The diagrams below show two similar shapes, *ABCD* and *PQRS*.



Diagrams not drawn to scale

(a) Calculate the value of x. [2]

$$\frac{3.2}{x} = \frac{5.6}{8.4}$$

$$x = \frac{3.2 \times 8.4}{5.6} = 4.8 \text{ cm}$$

(b) Calculate the value of y. [2]

$$\frac{y}{6.3} = \frac{5.6}{8.4}$$

$$y = \frac{5.6 \times 6.3}{8.4} = 4.2$$

Examiner only

(c) Explain clearly why the following statement cannot be true. [2]

'The length of CD is 3·9 cm and the length of RS is 6·5 cm'.

$\frac{3.9}{6.5} = 0.6$

But

$\frac{5.6}{8.4} = 0.67$

So the comparison shows that $\frac{CD}{RS} \neq \frac{AB}{PQ}$

Thus the statement is not true

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Examiner only

8. A rectangle of length 12 cm and width $(2x - y)$ cm has an area of 72 cm^2.

Diagram not drawn to scale

KLMN is a kite where *KL* = $3x$ cm and *LM* = y cm.

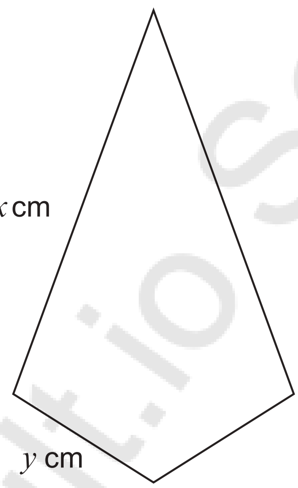

Diagram not drawn to scale

The perimeter of the kite *KLMN* = 33 cm.

Calculate the values of x and y.

You must show all your working.
Do not use a trial and improvement method. [5]

Area of triangle = L×B = 72

$\frac{12 \cdot (2x-y)}{12} = \frac{72}{12}$

$2x - y = \frac{72}{12}$

$2x - y = 6$

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Examiner only

Perimeter of the kite $= 3x + 3x + y + y = 33$

$6x + 2y = 33$

$2(3x + y) = 33$

$3x + y = \frac{33}{2}$

$3x + y = 16.5$

Solve the 2 equations as simultaneous equations

$2x - y = 6$

$3x + y = 16.5$

Add $\quad 5x = 22.5$

$x = \frac{22.5}{5} = 4.5$

Substitute $x = 4.5$ in $2x - y = 6$

$2(4.5) - y = 6$

$y = (4.5)2 - 6$

$y = 9 - 6$

$y = 3$

Answer $= \quad x = 4.5$

$y = 3$

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Examiner only

9. *ABC* and *CDE* are two right-angled triangles.

In triangle *ABC*, *AB* = 6·5 cm and *BC* = 10·4 cm.
In triangle *CDE*, *CE* = 9·4 cm.

$B\hat{C}E = 22°$.
$A\hat{C}B = x°$.

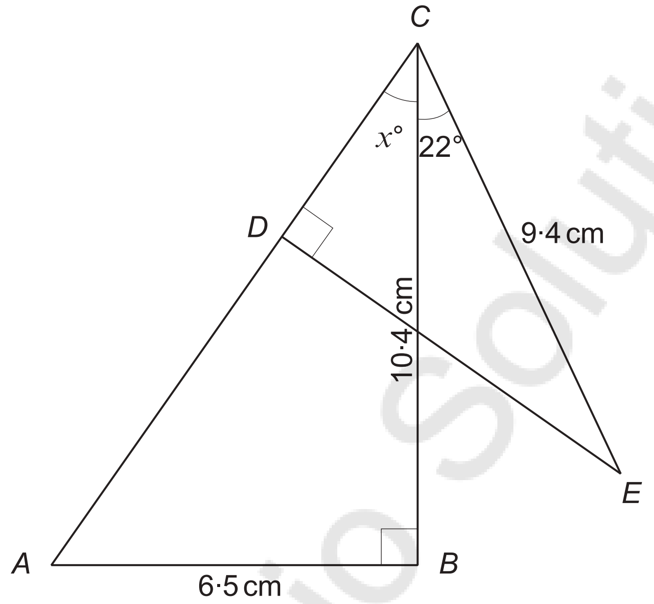

Diagram not drawn to scale

(a) Calculate the value of x. [3]

To find x = $\tan A\hat{C}B = \frac{6\cdot5}{10\cdot4}$

$A\hat{C}B = \tan^{-1}\left(\frac{6\cdot5}{10\cdot4}\right)$

$A\hat{C}B = 32°$

$\therefore x = 32°$

Examiner only

(b) Hence find the length of *DE*. [3]

$DE = 9.4 \times \sin(D\hat{C}E)$

$= 9.4 \times \sin(32 + 22)^{\circ}$

$DE = 7.6\text{ cm}$

Examiner only

10. Factorise $4m^2 - 289$. [2]

$(2m + 17)(2m - 17)$

11. Calculate the volume of a pyramid with a base area of 13 200 cm² and a perpendicular height of 460 cm.
Give your answer in m³. [3]

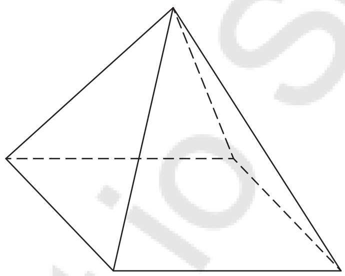

Diagram not drawn to scale

Volume of a pyramid $= \frac{hbw}{3}$ i.e. height x base width

Base area = base x width = 13200

$= \frac{460 \times 13200}{3}$

$= 2024000\ cm^3$

Convert to m^3 = divide x 10^6

$= 2.024\ m^3$

Volume = 2.024 m³

Examiner only

12. Five quadratic equations are listed below.
Draw a line connecting each equation to its solution.
One has been completed for you. [4]

Equation	Solution
$x^2 - 4 = 0$	$x = 1, x = -\frac{3}{2}$
	$x = 2, x = -2$
	$x = 1, x = \frac{3}{2}$
$x(2x + 3) = 0$	$x = \frac{4}{9}$
	$x = -1, x = -\frac{2}{3}$
	$x = -\frac{2}{3}, x = \frac{2}{3}$
	$x = \frac{3}{2}, x = -\frac{3}{2}$
$(x - 1)(2x - 3) = 0$	$x = 1, x = -\frac{2}{3}$
	$x = -\frac{9}{4}$
	$x = 0, x = \frac{2}{3}$
$(2x - 3)(2x + 3) = 0$	$x = \frac{81}{16}$
	$x = 0, x = -\frac{3}{2}$
	$x = \frac{3}{2}$
$(4x + 9)^2 = 0$	$x = -\frac{9}{4}, x = 0$

$x - 1 = 0 = 1$
$2x - 3 = 0$
$x = 3/2$

 (3300U60-1) Turn over.

Examiner only

13. The values a = 27, b = 1·9 and c = 0·81 are each correct to 2 significant figures.

Use the formula $d = \frac{a-b}{c}$ to calculate the **least** value of d.

You must show all your working. [3]

$d = \frac{26.5 - 1.95}{0.814} = \frac{24.55}{0.814}$

$= 30.12$

Examiner only

14. *A* and *B* are points on a circle with centre *O*.
Calculate the length of the arc *AB* shown below. [2]

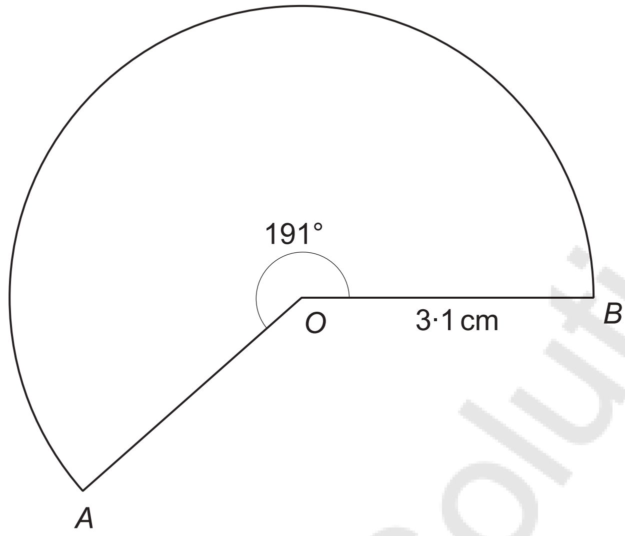

Diagram not drawn to scale

Length of arc $= \frac{\text{angle subtended}}{360} \times 2\pi r$

$= \frac{191}{360} \times 2 \times \pi \times 3.1$

$= 10.3$ cm

Turn over.

Examiner only

15. Express the following as a single fraction in its simplest form. [4]

$$\frac{2}{3x-5}-\frac{7}{11x-13}$$

$$\frac{2(11x-13)-7(3x-5)}{(3x-5)(11x-13)}$$

$$=\frac{22x-26-21x+35}{(3x-5)(11x-13)}$$

$$\frac{x+9}{33x^2-94x+65}$$ //

Examiner only

16. A bag contains 200 beads.
Some of the beads are red.
A bead is selected at random.
Its colour is recorded and then the bead is **replaced**.
A second bead is selected at random and its colour is also recorded.

The probability that two red beads are selected is 0·1369.
Calculate the number of red beads in the bag. [4]

$$\frac{n}{200} \times \frac{n}{200} = 0.1369$$

$$n^2 = 200 \times 200 \times 0.1369$$

$$n = \sqrt{200 \times 200 \times 0.1369}$$

No of red beads = $\underline{74}$

Examiner only

17. Solve the equation $(2x + 5)(3x - 11) = 7$.
Give your answers correct to 2 decimal places. [5]

Expand :-

$6x^2 - 22x + 15x - 55 = 7$

$6x^2 - 7x - 62 = 0$

$x = \dfrac{-(-7) \pm \sqrt{(-7)^2 - 4 \times 6 \times (-62)}}{2 \times 6}$

$x = \dfrac{7 \pm \sqrt{1537}}{12}$

$\therefore x = 3.85$ and $x = -2.68$
to 2 dp places

 (3300U60-1)

Examiner only

18. Make c the subject of the following formula. [4]

$$\sqrt{gc^2 - v} = c$$

$$\left(\sqrt{gc^2-v}\right)^2 = (c)^2$$

$$c^2 = gc^2 - v$$

$$gc^2 - c^2 = v$$

$$c^2(g-1) = v$$

$$c^2 = \frac{v}{g-1}$$

$$c = \pm\sqrt{\frac{v}{g-1}}$$

Examiner only

19. *BC* is the tangent to the circle at point *E*, as shown below.

$EC = 8$ cm, $AC = 11$ cm and $D\hat{C}E = 31°$.

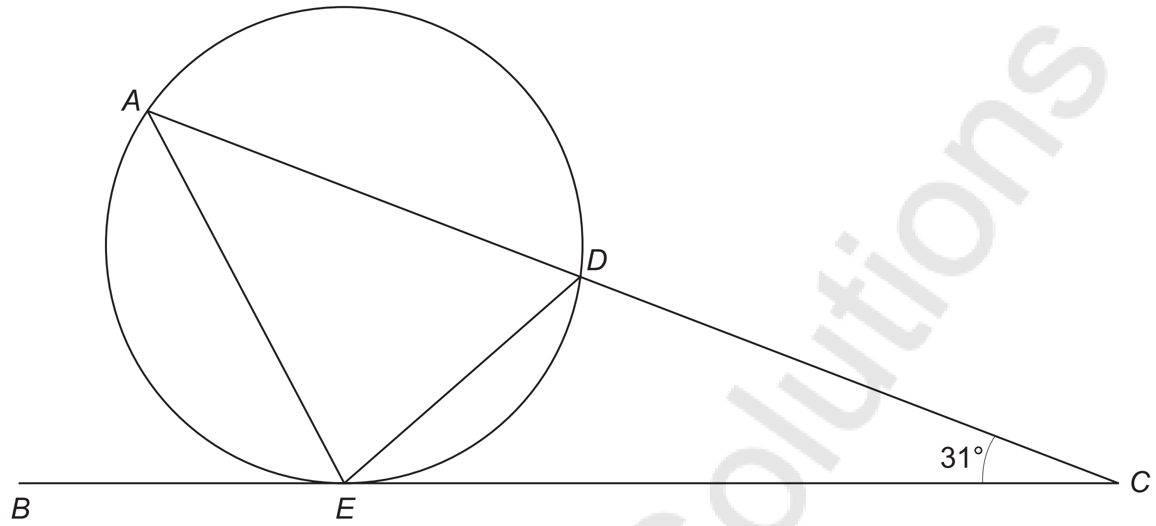

Diagram not drawn to scale

(a) Calculate the length of *AE*. [3]

$(AE)^2 = 8^2 + 11^2 - 2 \times 8 \times 11 \cos 31°$

using a calculator

$AE = 5.8$ cm

 (3300U60-1)

Examiner only

(b) Calculate the size of $C\hat{E}D$. [4]

$$\sin CAE = \frac{8 \times \sin 31}{5 \cdot 8}$$

$CAE = 44 \cdot 8°$

$C\hat{E}D = C\hat{A}E = 44 \cdot 8°$

Alternate method — $\cos CAE = \frac{11^2 + 5 \cdot 8^2 - 8^2}{2 \times 11 \times 5 \cdot 8} = 44 \cdot 8°$

END OF PAPER

Thank you!

 (3300U60-1)

Question number	Additional page, if required. Write the question number(s) in the left-hand margin.

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