OCR
RECOGNISING ACHIEVEMENT

SPECIMEN

GENERAL CERTIFICATE OF SECONDARY EDUCATION

MATHEMATICS B
Higher Tier

TERMINAL PAPER – SECTION B

Specimen

H **B294/B**

Time: 1 hour

Candidates answer on the question paper.
Additional Materials:
Scientific calculator
Geometric instruments
Tracing paper (optional)

Candidate Name	

Centre Number						Candidate Number				

INSTRUCTIONS TO CANDIDATES

- Write your name, centre number and candidate number in the boxes above.
- Answer **all** the questions.
- Write your answers, in blue or black ink, in the spaces provided on the question paper. Pencil may be used for graphs and diagrams only.
- Read each question carefully and make sure you know what you have to do before starting your answer.
- Show all your working. Marks may be given for working which shows that you know how to solve the problem, even if you get the answer wrong.
- Do **not** write in the bar code.
- Do **not** write outside the box bordering each page.
- WRITE YOUR ANSWER TO EACH QUESTION IN THE SPACE PROVIDED. ANSWERS WRITTEN ELSEWHERE WILL NOT BE MARKED.

INFORMATION FOR CANDIDATES

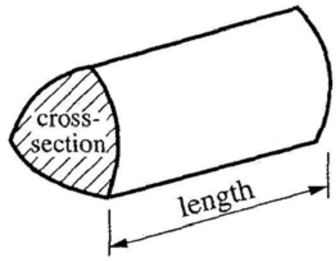
- You are expected to use a calculator in Section B of this paper.
- The number of marks is given in brackets [ ] at the end of each question or part question.
- The total number of marks in this section is 50.
- This section starts at question 12.
- Unless otherwise instructed take π to be 3.142 or use the π button on your calculator.

For Examiner's Use	
Section B	

This document consists of **16** printed pages.

FORMULAE SHEET

Volume of prism = (area of cross-section) × length

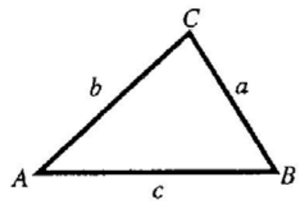


In any triangle ***ABC***

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

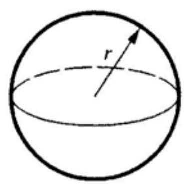
Cosine rule $a^2 = b^2 + c^2 - 2bc\cos A$

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



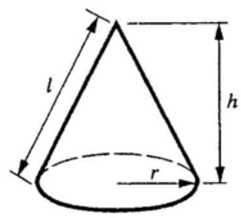
Volume of sphere $\dfrac{4}{3}\pi r^3$

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



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

Curved surface area of **cone** $= \pi rl$

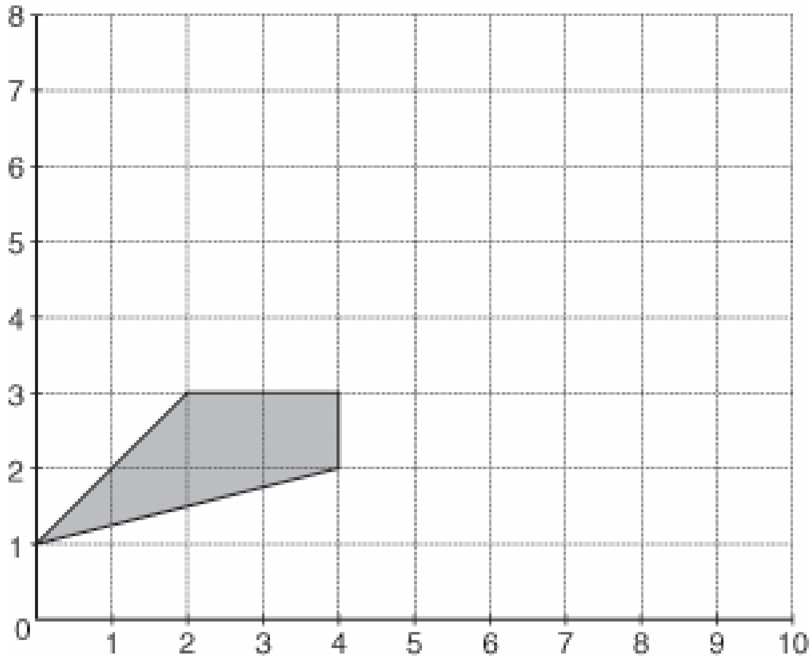


The Quadratic Equation

The solutions of $ax^2 + bx + c = 0$, where $a \neq 0$, are given by

$$x = \frac{-b \pm \sqrt{(b^2 - 4ac)}}{2a}$$

12 Part of a logo for a company takes the shape shown on the grid below.



The logo is completed with a second shape. This shape is an enlargement of the shape shown, centre the origin, scale factor 2.

Draw the completed logo on the grid. [3]

13 Mrs Dent wants her garden to be improved.
The cost of the design for the garden is £700.
The materials and plants cost £1200.
The cost of labour is £90 per day.

(a) Write a formula for the total cost, £*C*, of her garden when *n* days labour are needed.

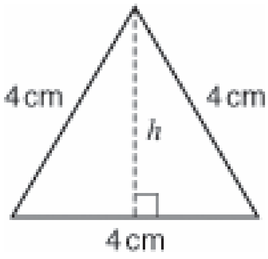
(a).................................[2]

(b) Write an equation and solve it to find how many days labour are needed.

(b).................................[3]

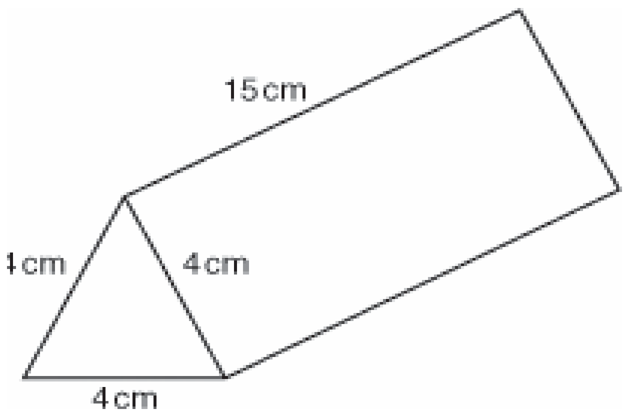
[Turn Over

14 **(a)** Show that the height of an equilateral triangle with sides of length 4 cm is 3.5 cm, correct to 1 decimal place. [3]



(b) The end of the prism shown is an equilateral triangle of side 4 cm.
The prism is 15 cm long.

Calculate the volume of the prism.

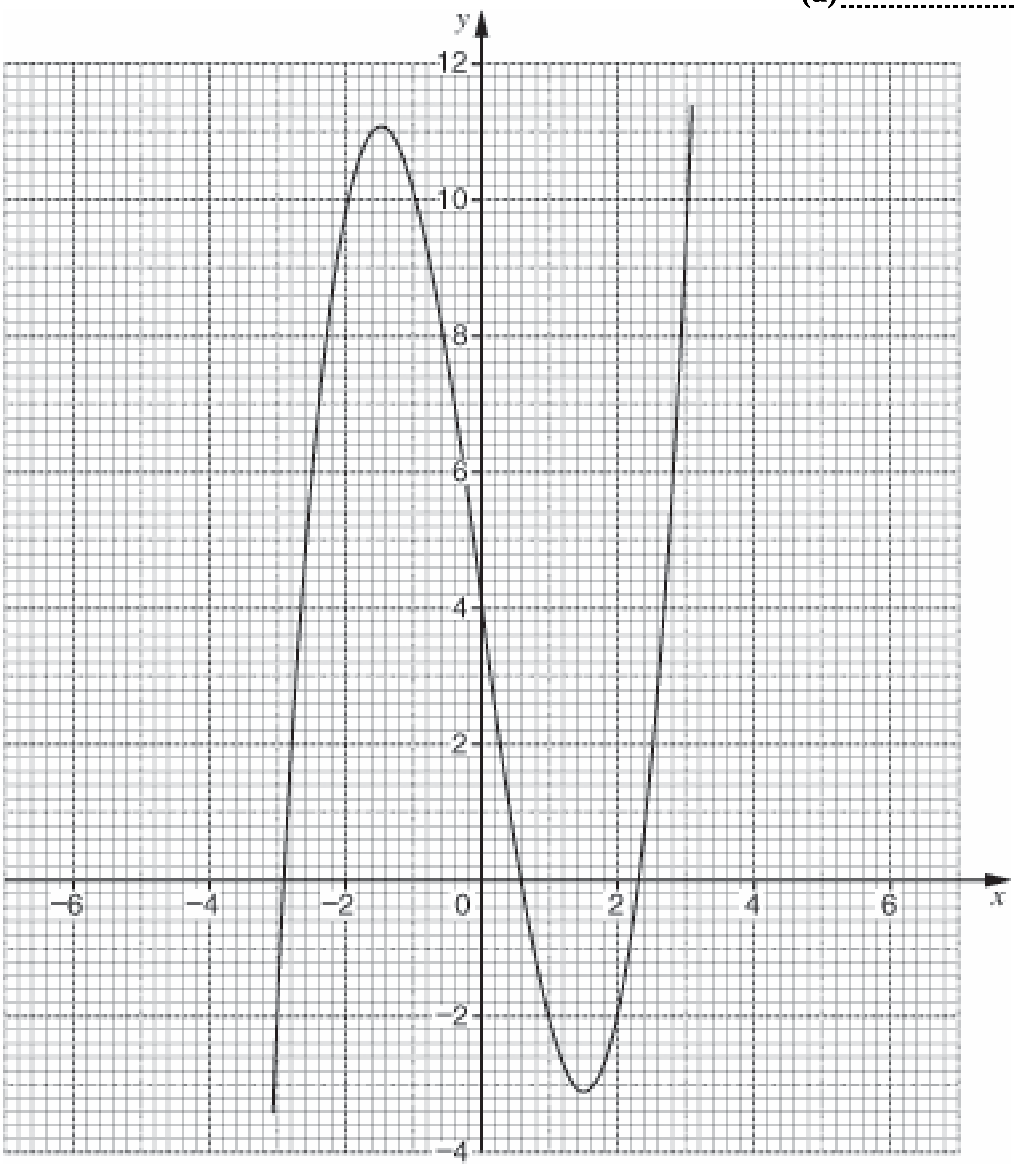


(b)………………..…...… [3]

15 The graph of $y = x^3 - 7x + 4$ is shown below.

(a) Use the graph to solve the equation $x^3 - 7x + 4 = 0$.

(a).................................[3]



(b) For this function, show that when $x = 6$, $y > 100$. [1]

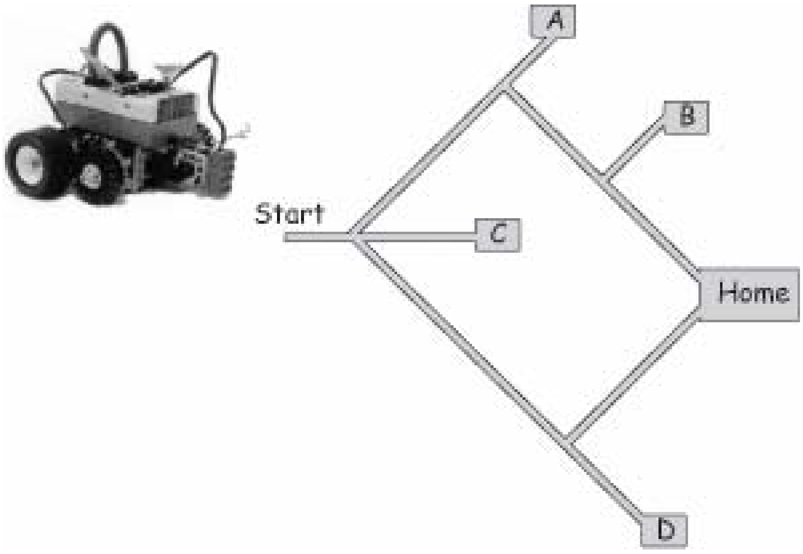
(c) The line $y = k$ meets the curve more than once.
Find the maximum value of k.

(c).......................[1]

[Turn Over

16 This robot travels along the track from the start.
When it reaches a junction it chooses one of the paths with equal probability.

When it reaches a dead end (A, B, C, D or Home) it stops.
The robot cannot turn back.



(a) Show that the probability of the robot reaching A from the start is $\frac{1}{6}$.

[1]

b) Find the probability of the robot reaching B from the start.

(b)........................[1]

(c) Work out the probability of the robot reaching Home from the start.
Show your method clearly.

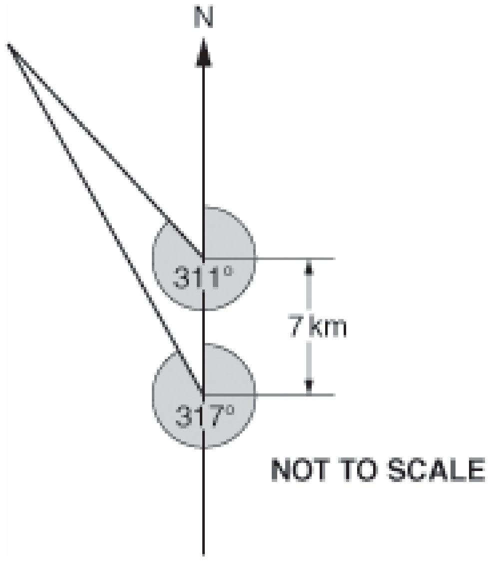
(c)........................[3]

17 A team is surveying a large flat region.

The bearing of a distant mountain is 317°.

The team moves north, in a straight line, for 7 km.
The bearing of the mountain is now 311°.

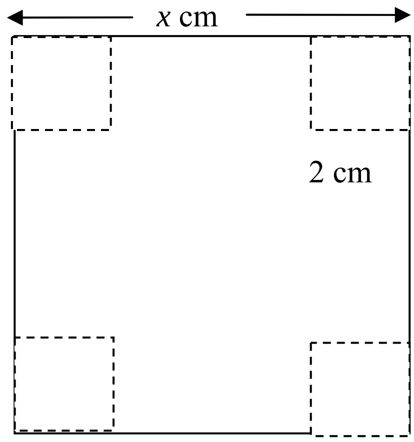
How far is the team from the mountain now?



………………. km [4]

[Turn Over

18 A box is to be made from a piece of square card of side x cm.
From each corner a square of side 2 cm is cut and the sides folded up to form an open box.



(a) Show that the volume, V cm^3, of the box is given by $V = 2x^2 - 16x + 32$. [3]

(b) The volume of the box is 100 cm^3. Find the value of x correct to 1 decimal place.

(b)........................[3]

19 The population of Russia was estimated as 146 000 000.

(a) Write 146 000 000 in standard form.

(a) ....[1]

The electricity consumption in a year for Russia was 7.02×10^{11} kilowatt hours.

(b) Calculate the average consumption per person.
Give your answer to a suitable degree of accuracy.

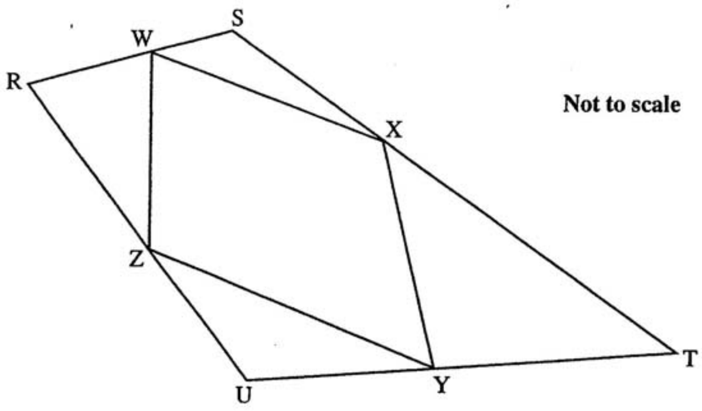
(b) .... kilowatt hours [3]

[Turn Over

20 RSTU is a quadrilateral.

$\overrightarrow{RS} = 2\mathbf{a}$, $\overrightarrow{ST} = 2\mathbf{b}$, $\overrightarrow{TU} = 2\mathbf{c}$, and $\overrightarrow{UR} = 2\mathbf{d}$.

W, X, Y and Z are the midpoints of the sides RS, ST, TU and UR.



(a) Explain why $2\mathbf{a} + 2\mathbf{b} + 2\mathbf{c} + 2\mathbf{d} = 0$. [1]

(b) Express $\overrightarrow{WX}$ in terms of **a** and **b**.

(b)..[1]

(c) Express $\overrightarrow{ZY}$ in terms of **c** and **d**.

(c)..[1]

(d) Show that $\overrightarrow{WX} = \overrightarrow{ZY}$ [1]

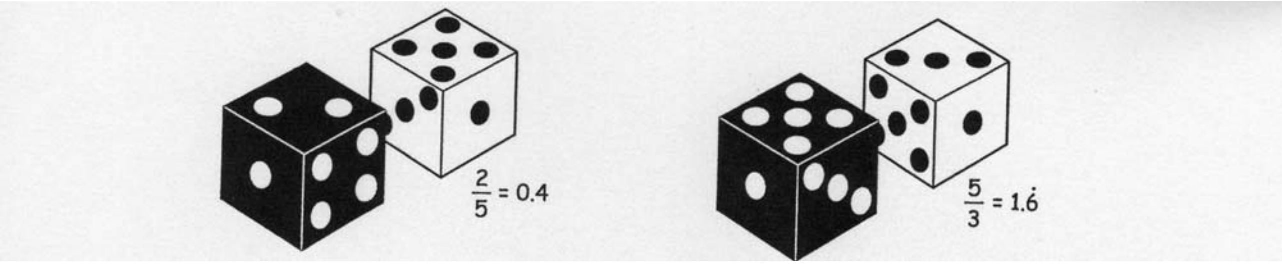
(e) Prove that WXYZ is a parallelogram. [2]

21 Ms Wilson has designed a game to give her students practice at changing fractions into decimals.

The game uses two ordinary fair dice, one black and the other white.
The dice are rolled and the numbers shown are noted.

Students have to change the fraction $\dfrac{\text{number on black die}}{\text{number on white die}}$ into a decimal.

For example,



(a) Erik rolls the two dice once.

Show that the probability that he gets a fraction which gives a recurring decimal is $\frac{2}{9}$. [3]

(b) Ela rolls the two dice twice.

What is the probability of her getting a fraction giving a recurring decimal at least once?

(b)..[3]

Section B Total 50

OXFORD CAMBRIDGE AND RSA EXAMINATIONS

General Certificate of Secondary Education

MATHEMATICS B B294/B

TERMINAL PAPER – SECTION B

Specimen Mark Scheme

The maximum mark for this paper is 50.

Section B					
12		Correct shape	**B1** **B1** **B1**	**3**	Same shape Twice as large All correct
13	**(a)**	$C = 700 + 1200 + 90n$	**M1** **A1**	**2**	
	(b)	$2395 = 1900 + 90n$ $\Rightarrow 90n = 2395 - 1900 = 495$ $\Rightarrow n = 5.5$	**M1** **A1** **A1**	**3**	
14	**(a)**	$h = \sqrt{4^2 - 2^2}$ $= \sqrt{12} = 3.5$	**M1** **B1** **A1**	**3**	Pythagoras Sight of 2
	(b)	$V = \frac{1}{2} \times 4 \times 3.5 \times 15$ $= 105$ cm^3	**M1** **A1** **B1**	**3**	Area of triangle Area × length Units mark
15	**(a)**	$x = -2.9$, 0.6 or 2.3	**B1** **B1** **B1**	**3**	One mark for each root. Each ±0.2
	(b)	When $x = 6$, $y = 6^3 - 42 + 4 = 178$	**B1**	**1**	
	(c)	Max $k \sim 11.1$	**B1**	**1**	
16	**(a)**	P(reaches A) = P(l at 1st jn)P(ahead at 2nd) $\frac{1}{3} \times \frac{1}{2} = \frac{1}{6}$	**B1**	**1**	
	(b)	$\frac{1}{3} \times \frac{1}{2} \times \frac{1}{2} = \frac{1}{12}$	**B1**	**1**	
	(c)	2 routes $\frac{1}{3} \times \frac{1}{2} \times \frac{1}{2} = \frac{1}{12}$ and $\frac{1}{3} \times \frac{1}{2}$ $\Rightarrow \frac{1}{12} + \frac{1}{6} = \frac{1}{4}$	**M1** **A1** **A1**	**3**	Add two sets of probabilities One with 3 fractions, the other with 2
17		Angles of triangle 43°, 131°, 6° Sin rule $\frac{x}{\sin 43} = \frac{7}{\sin 6}$ $\Rightarrow x = \frac{7 \sin 43}{\sin 6} = 45.7$ km	**B1** **M1** **A1** **A1**	**4**	Angles correct Sin rule Correct substitution into sin rule

18	**(a)**	Sides are $x - 4$ So Area of base = $(x - 4)^2$ Volume = $2(x - 4)^2$ $= 2x^2 - 16x + 32$	**B1** **M1** **A1**	**3**	
	(b)	$2x^2 - 16x + 32 = 100$ $\Rightarrow x^2 - 8x - 34 = 0$ $\Rightarrow x = \frac{8 \pm \sqrt{64+136}}{2} = \frac{8 \pm \sqrt{200}}{2}$ $= \frac{8+14.14}{2} = 11.1$	**B1** **M1** ` **A1**	**3**	
19	**(a)**	146 000 000 = 1.46×10^8	**B1**	**1**	
	(b)	$\frac{7.02 \times 10^{11}}{1.46 \times 10^8} = 4.81 \times 10^3$	**M1** **A2**	**3**	2 d.p. **A1** For figs 4.81 or 10^3 seen
20	**(a)**	Because the sides of the quadrilateral taken in order are represented by the vectors and so you start and finish at the same place.	**B1**	**1**	
	(b)	$\overrightarrow{WX} = \overrightarrow{WS} + \overrightarrow{SX}$ $= \mathbf{a} + \mathbf{b}$	**B1**	**1**	
	(c)	$\overrightarrow{ZY} = \overrightarrow{ZU} + \overrightarrow{UY}$ $= -(\mathbf{c} + \mathbf{d})$	**B1**	**1**	Must include the -ve sign
	(d)	From (i) $\mathbf{a} + \mathbf{b} + \mathbf{c} + \mathbf{d} = 0$ $\Rightarrow \mathbf{a} + \mathbf{b} = -(\mathbf{c} + \mathbf{d})$ $\Rightarrow \overrightarrow{WX} = \overrightarrow{ZY}$	**B1**	**1**	
	(e)	Since two opposite sides are equal and parallel the quadrilateral is a parallelogram.	**B1** **B1**	**2**	Two opposite sides Equal and parallel

21	**(a)**	White die must show 3 or 6 with probability $\frac{1}{3}$. Black die must show 1, 2, 4 or 5 with probability $\frac{2}{3}$. $\Rightarrow$ P(recurring decimal) = $\frac{1}{3}\times\frac{2}{3}=\frac{2}{9}$	**M1** **M1** **A1**	**3**	Multiply probabilities Idea of the selection
	(b)	Rec.dec and non-rec.dec × 2 + rec.dec twice Or 1 - non-rec dec twice $\frac{2}{9}\times\frac{7}{9}\times 2+\left(\frac{2}{9}\right)^2=\frac{32}{81}$ or $1-\left(\frac{7}{9}\right)^2=1-\frac{49}{81}=\frac{32}{81}$	**M1** **A1** **A1**	**3**	

Section B Total 50

Assessment Objectives Grid

Question	AO2	AO3	AO4	Total
12		3		**3**
13	5			**5**
14		6		**6**
15	5			**5**
16			5	**5**
17		4		**4**
18	6			**6**
19	4			**4**
20		6		**6**
21			6	**6**
Totals	**20**	**19**	**11**	**50**