OCR
RECOGNISING ACHIEVEMENT

OXFORD CAMBRIDGE AND RSA EXAMINATIONS
General Certificate of Secondary Education

MATHEMATICS B (MEI) 1968/2316B

PAPER 2 SECTION B
HIGHER TIER

Wednesday **15 JUNE 2005** Morning 1 hour

Candidates answer on the question paper.
Additional materials:
Geometrical instruments
Scientific or graphical calculator
Tracing paper (optional)

Candidate Name	Centre Number	Candidate Number

TIME 1 hour

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.
- 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.

INFORMATION FOR CANDIDATES

- The number of marks is given in brackets [ ] at the end of each question or part question.
- Unless otherwise instructed in the question, take π to be 3.142 or use the π button on your calculator.
- The total number of marks for this section is 50.
- Section B starts with question 11.

FOR EXAMINER'S USE	
Section B	

This question paper consists of 11 printed pages and 1 blank page.

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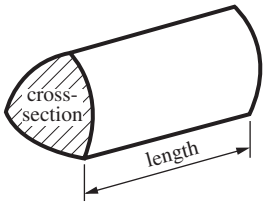
Formulae Sheet: Higher Tier

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

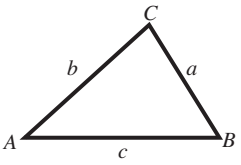


In any triangle *ABC*

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

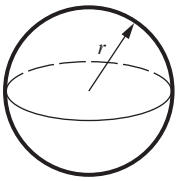
Cosine rule $a^2 = b^2 + c^2 - 2bc\cos A$

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



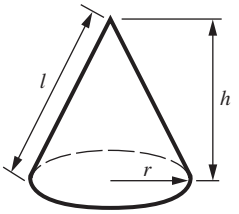
Volume of sphere = $\frac{4}{3}\pi r^3$

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



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

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

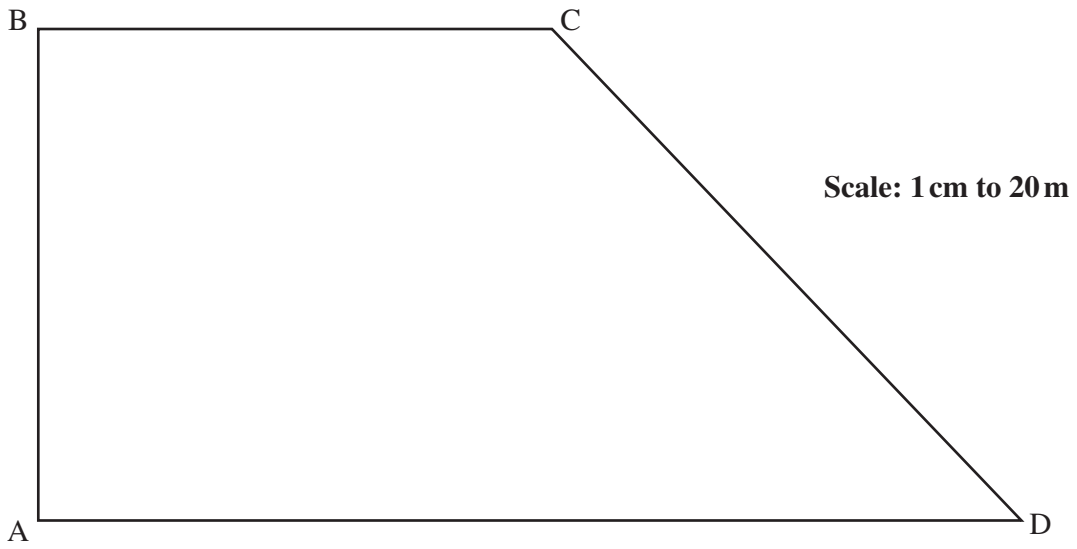


The Quadratic Equation

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

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

11



The scale drawing shows Southmore Park.
A celebrity is visiting to plant a tree in the park.
The tree will be planted more than 50 m from B.
It will be more than 40 m from CD.

Shade the region where the tree can be planted. [4]

12 Jim was travelling at 100 km per hour.
He sneezed and was distracted for 1.5 s.

How far did he travel in that time?
Give your answer in metres.

.....m [4]

13 Use trial and improvement to find the solution of the equation

$$x^3 - 2x = 6.$$

Give your answer correct to 1 decimal place.
Show clearly your trials and their outcomes.

.....[4]

14 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]

15 Complete this algebraic multiplication grid.
Do not leave any brackets in your answers.

×	$x + 1$	$x + 2$	.....
$x - 1$	.....	$x^2 + x - 2$	$2x^2 - 3x + 1$
$x + 2$	$x^2 + 3x + 2$	.....	$2x^2 + 3x - 2$

[5]

[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.

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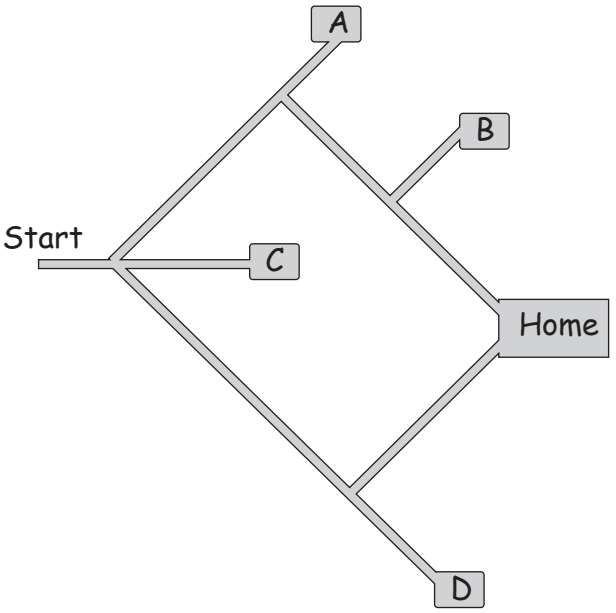
Details: An image of a robot



(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.

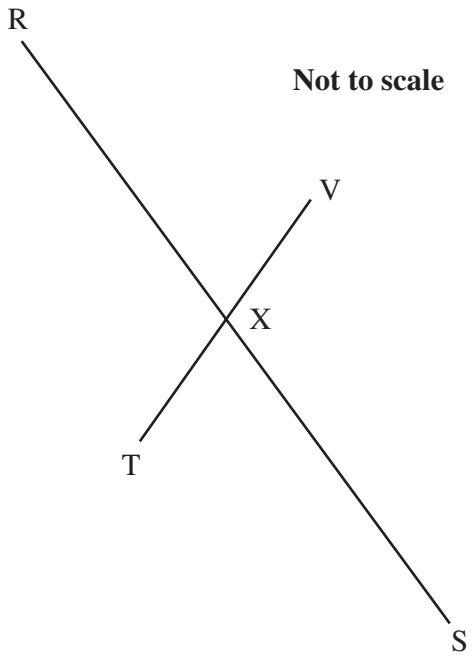
(b) .....[1]

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

(c) .....[3]

17 Two straight lines RS and TV bisect each other at X.

Use congruent triangles to prove that RT = VS. [4]



18 A team is surveying a large flat region.

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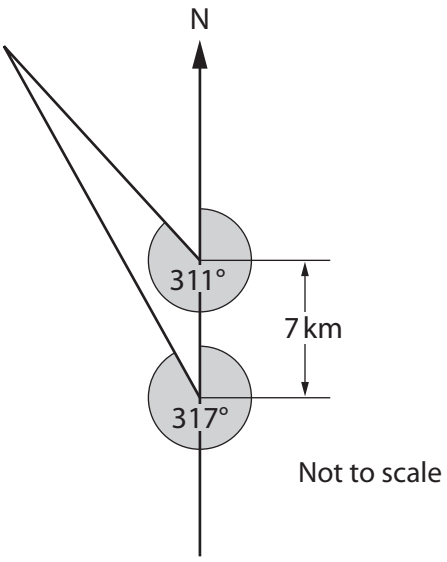
Details: An image of two people on a large flat piece of land with a mountain in the distance

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?

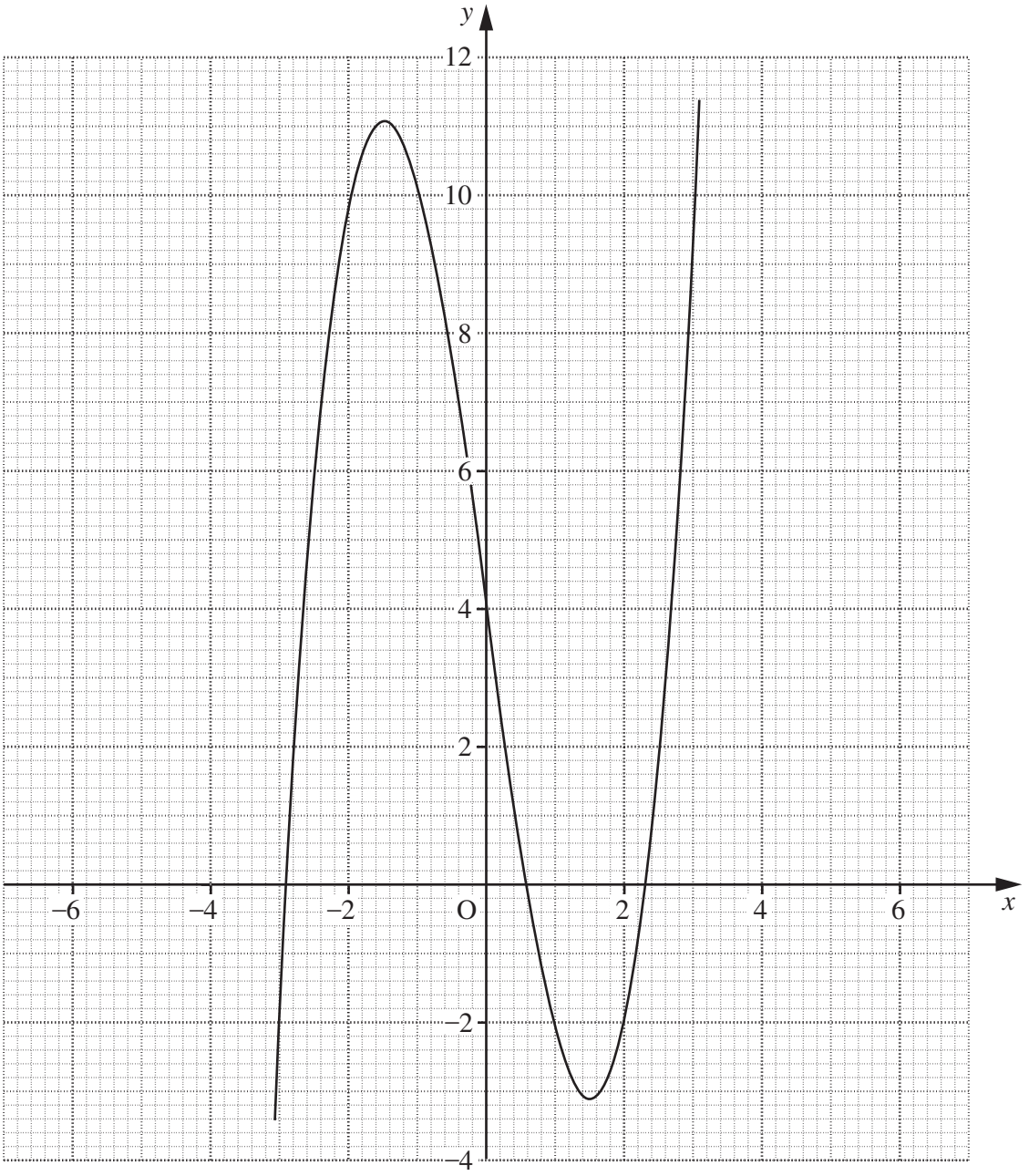


.....km [4]

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

(a) By drawing a line on the grid, solve the equation $x^3 - 8x + 2 = 0$.

(a) .....[3]



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

(b) .....[1]

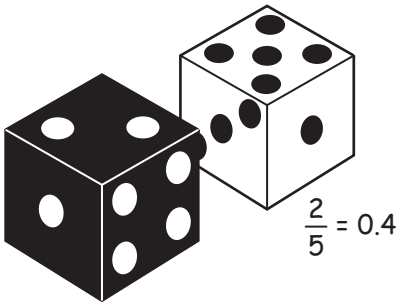
[Turn over

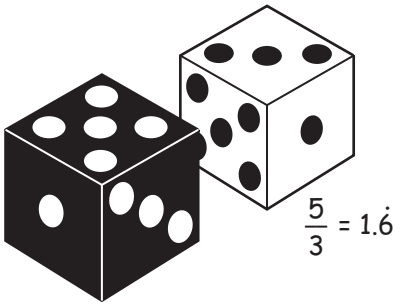
20 Ms Wilson has designed a game to give her students practice at changing fractions into decimals.

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

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

For example,





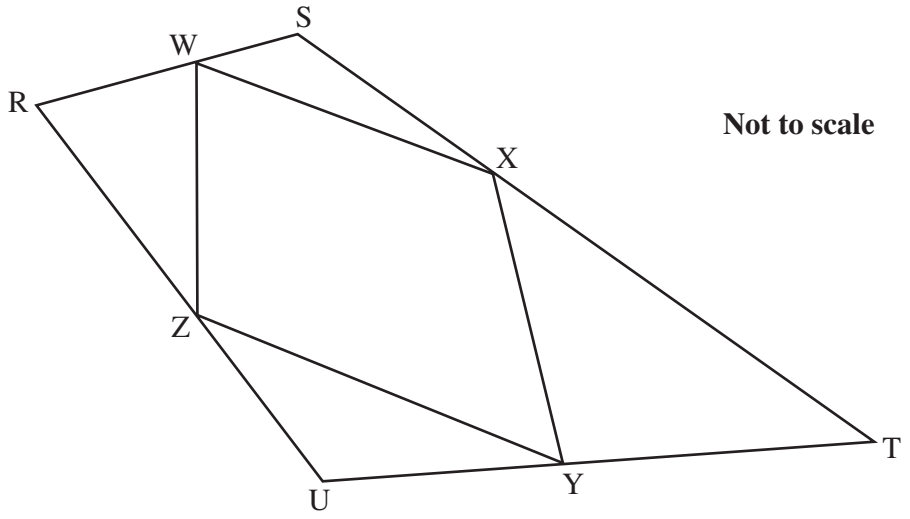
(a) Erik rolls the two dice once.
Show that the probability he gets a fraction which gives a recurring decimal is $\frac{2}{9}$. [3]

(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]

21 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**. [1]

(c) Express $\overrightarrow{ZY}$ in terms of **c** and **d**. [1]

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

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

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