RECOGNISING ACHIEVEMENT

Oxford Cambridge and RSA Examinations

General Certificate of Secondary Education

Mathematics C (Graduated Assessment) 1966/2343A (H)

HIGHER TIER TERMINAL PAPER – SECTION A

Specimen Paper 2003

Candidates answer on the question paper.

Additional materials:

Tracing paper
Geometrical instruments

TIME 1 hour

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.
- Read each question carefully and make sure you know what you have to do before starting your answer.
- There is a space after most questions. Use it to do your working. In many questions marks will be given for correct working even if the answer is incorrect.

INFORMATION FOR CANDIDATES

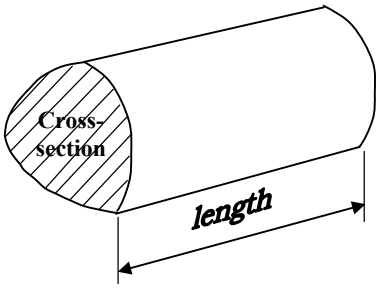
- The number of marks is given in brackets [ ] at the end of each question or part question.
- The total mark available for this section is 50.

For Examiner's use only	
Section A	
Section B	
Total	

WARNING
You are not allowed to use a calculator in Section A of this paper.

FORMULA SHEET: HIGHER TIER

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

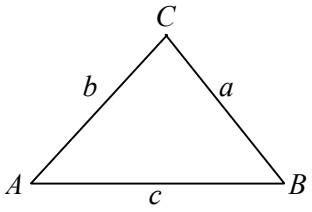


In any triangle ABC

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

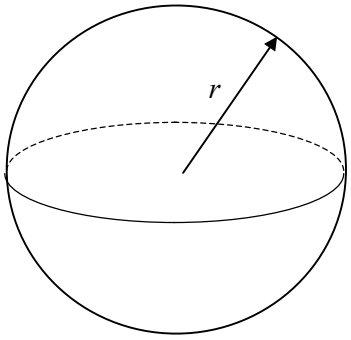
Cosine rule $a^2 = b^2 + c^2 - 2bc\cos A$

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



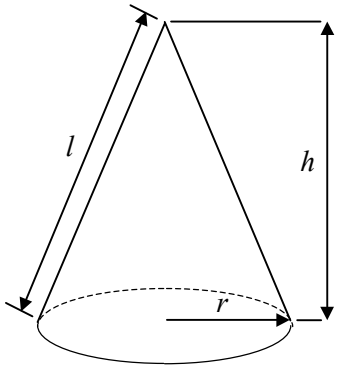
Volume of sphere = $\frac{4}{3}\pi r^3$

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



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

Curved surface area of cone = πrl



The Quadratic Equation

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

1 **(a)** A machine produces pieces of wood.
The length of each piece of wood measures 34 mm, correct to the nearest millimetre.

Between what limits does the actual length lie?

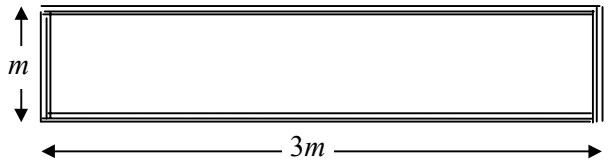
(a) The length is between _____ mm and _____ mm [2]

(b) Three of these pieces of wood are put together to make a triangle.

What is the greatest possible perimeter of the triangle?

(b) _____ mm [1]

(c) Another machine produces pieces of metal of length m.
Some pieces of metal are fixed together to make this rectangle.



The maximum possible perimeter of this rectangle is 52 millimetres.
The minimum possible perimeter of this rectangle is 44 millimetres.

(i) Write down one inequality in m.

(c)(i) _____ [1]

(ii) Between what limits does m lie?

(ii) between _____ and _____ [1]

5

2 **(a)** Multiply out and simplify $3(2x + 1) – 2(x – 1)$.

(a)_____ [2]

(b) Rearrange the formula $A = 2\pi rh + \pi r^2$ to make h the subject.

(b) $h =$ _____ [2]

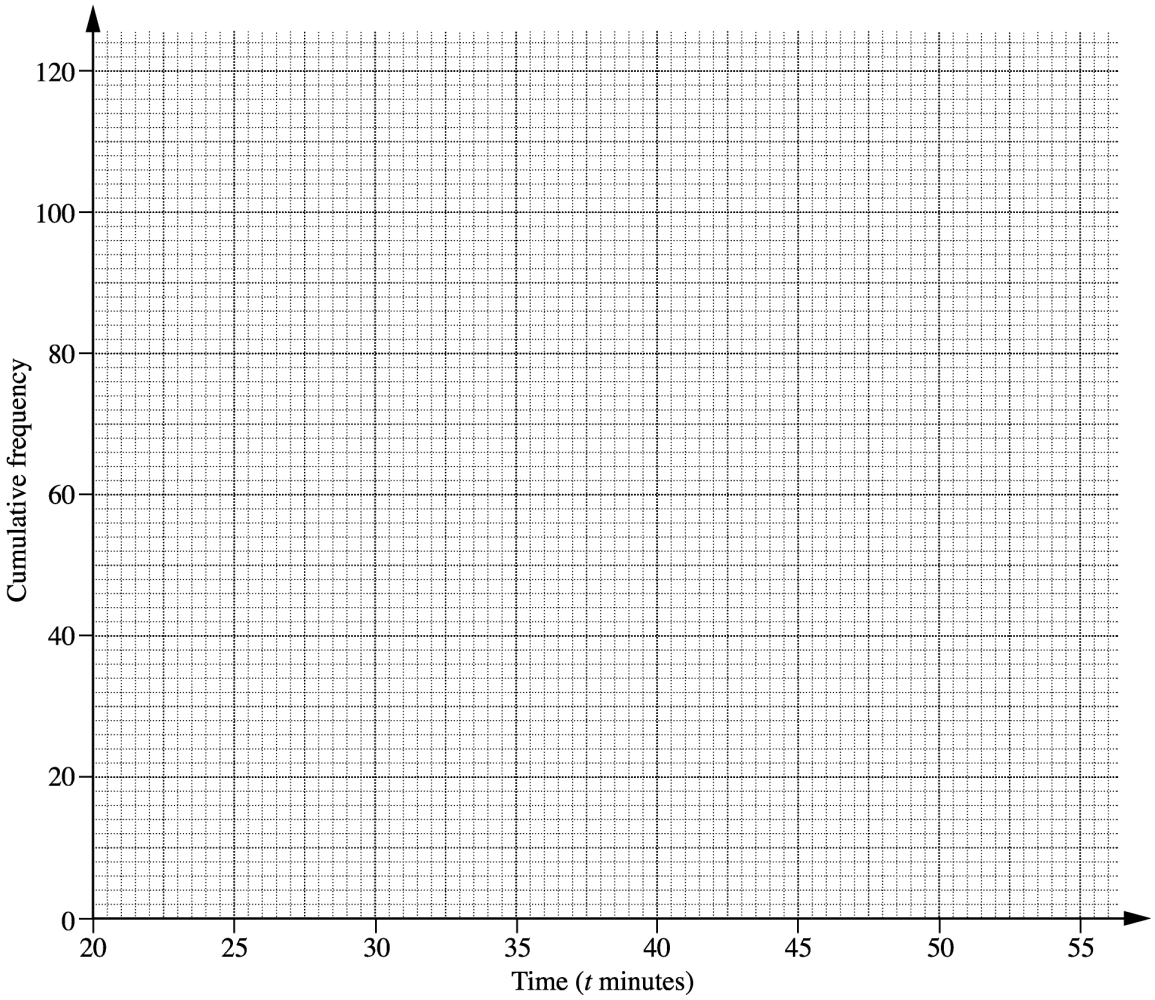
4

3 The times taken by 120 students to complete a problem were recorded.

The results are shown in the table below.

Time (t minutes)	$20 < t \leq 25$	$25 < t \leq 30$	$30 < t \leq 35$	$35 < t \leq 40$	$40 < t \leq 45$	$45 < t \leq 50$
Frequency	2	17	35	42	17	7

(a) Draw a cumulative frequency graph for the data.



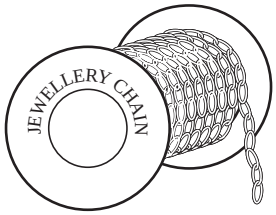
[3]

(b) Find the median time.

(b) _____minutes [1]

4

4 This gold chain is sold in inches.



(a) One inch of the chain weighs $1\frac{1}{2}$ ounces.

Jane buys a $6\frac{1}{2}$ inch chain.

(i) How much does it weigh?

(a)(i) _____ ounces [1]

(ii) She makes a necklace using this chain, a clip weighing $\frac{3}{16}$ ounce and a pendant weighing $\frac{1}{8}$ ounce.

How much does the necklace weigh altogether?

(ii) _____ ounces [1]

(b) Fred buys a $22\frac{3}{4}$ inch chain and cuts it into a length for a necklace and a length for a bracelet in the ratio 9 : 4.

Calculate the length of the chain for the necklace.

(b) _____ inches [2]

4

5 **(a)** Simplify $\frac{4a^4b^3}{6ab^2}$.

(a) _____ [2]

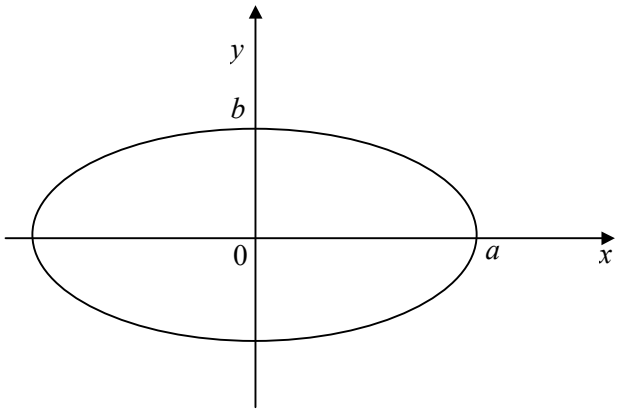
(b) Solve the equation $x^2 + 7x + 12 = 0$.

(b) x = _____ [3]

5

6 This is a sketch of an ellipse.

It is symmetrical about both axes.



Which of the following could possibly be an expression for its area?

$2\pi\sqrt{ab}$ $\quad$ $\pi(a+b)$ $\quad$ $\frac{1}{2}\pi\sqrt{a^2+b^2}$ $\quad$ πab $\quad$ $\pi(ab)^2$

You must explain how you made your choice.

_____because _____

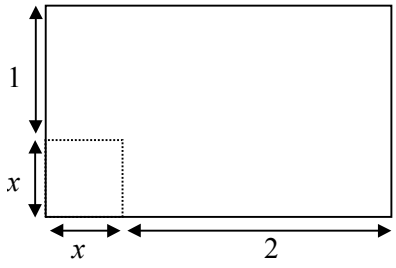
_____

_____ [2]

2

7 A rectangle has sides of length $x + 1$ and $x + 2$.
The area of the rectangle is 42.

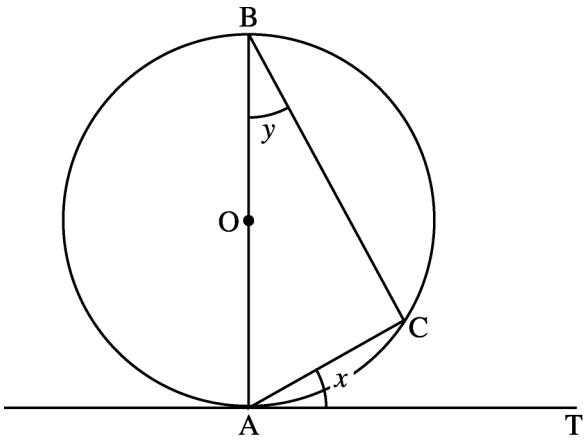
Form an equation in x and solve it to find x.



$x =$ _____ [4]

4

8



O is the centre of the circle. AT is a tangent to the circle at A.

Show clearly that the angles marked x and y are equal.
You must give a clear reason for each statement you make.
(It is not sufficient merely to quote 'angles in the alternate segment').

_____

_____

_____

_____

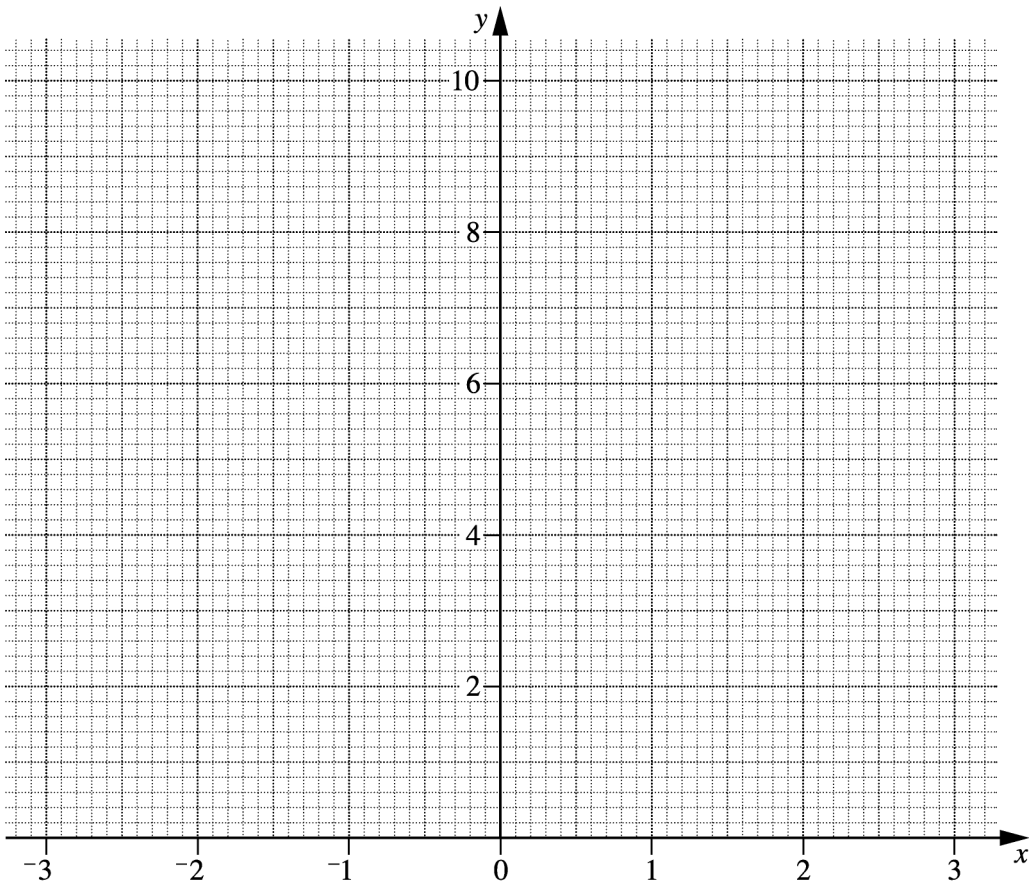
_____

_____

_____ [4]

4

9 **(a)** Draw a graph of $y = 2^x$ for values of x from -3 to 3.



[2]

(b) Use your graph to estimate the positive solution of the equation.

$2^x - x = 3$

correct to one decimal place.

(b) _____ [2]

4

10 **(a)** The mass of a radioactive element decays exponentially.

At time t the mass was 1 gram.
At time $t + 1$ the mass was $0\cdot\dot{7}\dot{5}$ gram.

Find the decay factor as a fraction in its simplest form.

(a) _____ [2]

(b) The surface area of a mould grows exponentially.

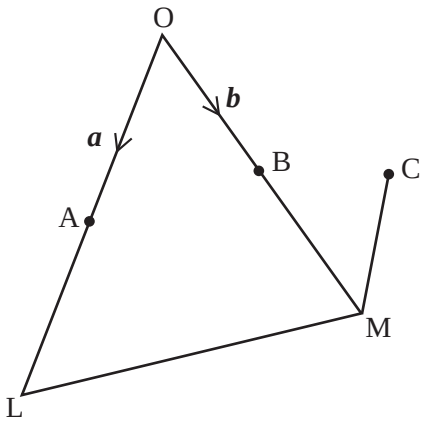
At time t the area was $\sqrt{6}-\sqrt{2}\,\text{cm}^2$.
At time $t + 1$ the area was $\sqrt{6}+\sqrt{2}\,\text{cm}^2$.

Find the growth factor, giving your answer in its simplest form.

(b) _____ [2]

4

11



In the diagram $\overrightarrow{AO}$ = **a** and $\overrightarrow{OB}$ = **b**.

A and B are the midpoints of OL and OM respectively.

$\overrightarrow{MC} = \overrightarrow{LA}$.

(a) Write down $\overrightarrow{AB}$ in terms of **a** and **b**.

(a) $\overrightarrow{AB}$ = _____ [1]

(b) Show that B is the midpoint of AC.

_____

_____

_____

_____

_____

_____ [4]

5

12 The straight line with equation $y = x + 6$ meets the circle with equation $x^2 + y^2 = 50$ at two points P and Q.

By solving two simultaneous equations, find the coordinates of P and Q.

(_____,_____) and (_____,_____) [5]

5

RECOGNISING ACHIEVEMENT

Oxford Cambridge and RSA Examinations

General Certificate of Secondary Education

Mathematics C (Graduated Assessment) 1966/2343B (H)

HIGHER TIER TERMINAL PAPER – SECTION B

Specimen Paper 2003

Additional materials:

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Geometrical instruments
Scientific or Graphical Calculator

TIME 1 hour

Candidate Name	Centre Number	Candidate Number

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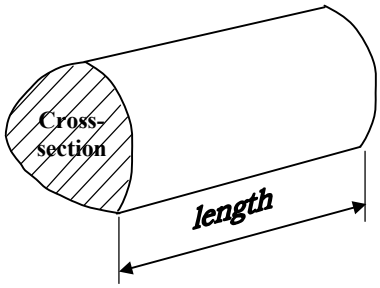
For Examiners' Use	
Section B	

FORMULA SHEET: HIGHER TIER

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



In any triangle ABC

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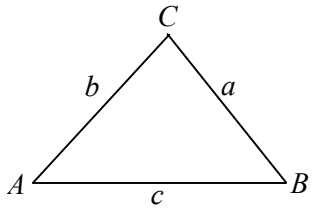
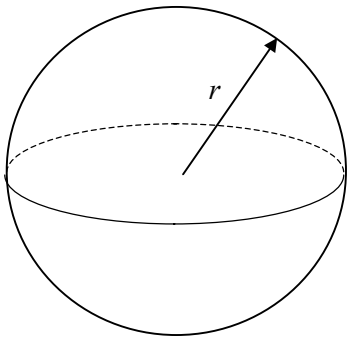
Cosine rule $a^2 = b^2 + c^2 - 2bc\cos A$

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



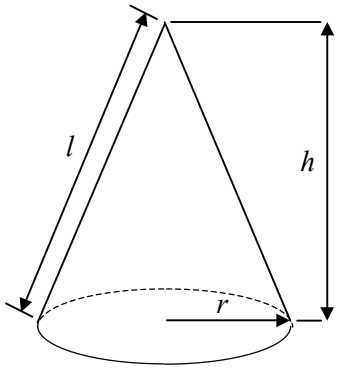
Volume of sphere = $\frac{4}{3}\pi r^3$

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



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

Curved surface area of cone = πrl



The Quadratic Equation

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

13 **(a)** Calculate $100 - \sqrt{5 \times 5{\cdot}12 - 9{\cdot}6}$.

(a) _____ [1]

(b) Calculate the following.

The sum of the cube of 12·5 and the square of 4·5 is divided by the difference between 2·54 and the reciprocal of 2·5

(b) _____ [1]

2

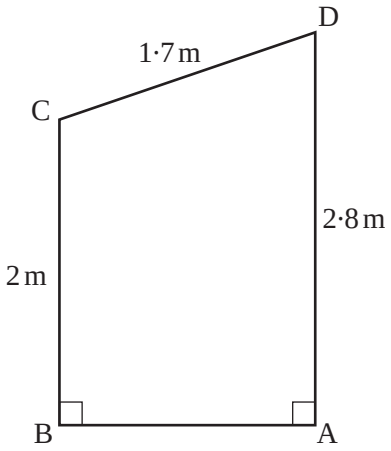
14 The equation $x^3 - 2x - 1 = 0$ has a solution between 1 and 2.

Use trial and improvement to find the solution correct to two decimal places.
You must show your trials.

$x =$ _____ [4]

4

15 The diagram shows the end, ABCD, of a shed.
The shed is standing on horizontal ground.



Not to scale

(a) Calculate the area of ABCD.

(a) _____ m^2 [6]

(b) Calculate the angle CD makes with the horizontal.

(b) _____ ° [3]

9

16 Mrs Bates invested some money in a savings account.
The rate of interest was fixed at 7% per annum.
Interest was added at the end of each year.
At the end of the third year there was £3675·13 in the account.

How much did Mrs Bates invest?

£ _____ [3]

3

17 **(a)** Ten years ago the population of Japan was $1{\cdot}15\times10^8$.
The population is now $1{\cdot}1983\times10^8$.

Calculate the percentage increase in the population.

(a) _____% [2]

(b) The table shows the populations of three countries.

Country	Population
France	$6{\cdot}12\times10^7$
Finland	$7{\cdot}24\times10^6$
U.S.A.	$2{\cdot}16\times10^8$

(i) Calculate the total population of the three countries.
Give your answer to a reasonable degree of accuracy.

(b)(i) _____ [2]

(ii) The area of France is 213 000 square miles.

Calculate the average number of people per square mile in France.

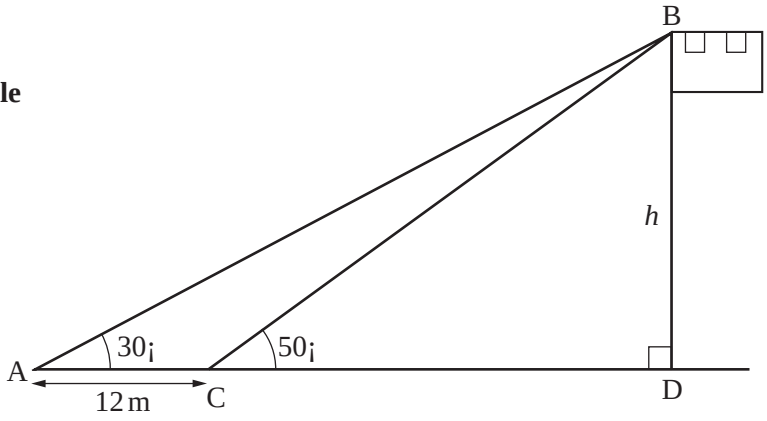
(ii) _____ [2]

6

18 The diagram shows a vertical flagpole of height h metres, standing on horizontal ground.

Calculate the height, h, of the flagpole.

Not to scale



$h =$ _____ m [5]

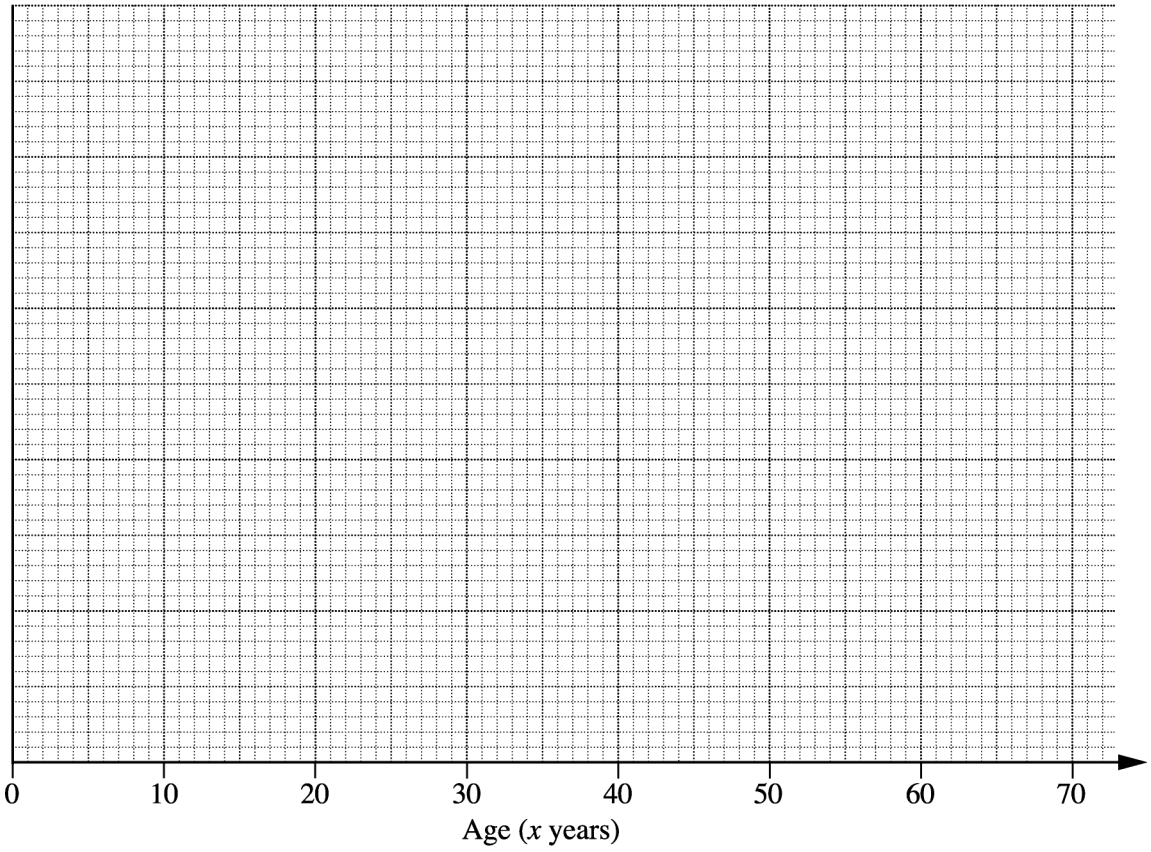
5

19 The table shows the distribution of the ages, x years, of 100 passengers on a flight from Heathrow airport.

Age (x years)	Number of passengers
$0 \leq x < 20$	14
$20 \leq x < 40$	24
$40 \leq x < 50$	36
$50 \leq x < 60$	21
$60 \leq x < 70$	5
$70 \leq x$	0

Draw a histogram to illustrate these data.

Mark and label the scale on the vertical axis.



[4]

4

20 Simplify $\frac{3x^2-5x-2}{3x^2-12}$.

_____ [4]

4

21 A driving test examiner knows from experience that, if learners have lessons with a driving school, the probability they will pass the test is 0·6. Otherwise the probability they will pass the test is 0·1.

80% of those she examines have had lessons with a driving school.

(a) Show clearly that the probability a learner driver, chosen at random, will pass the test is 0·5.

[2]

(b) The examiner tests three learner drivers.

Calculate the probability that exactly one of these passes the test.

(b) _____ [2]

4

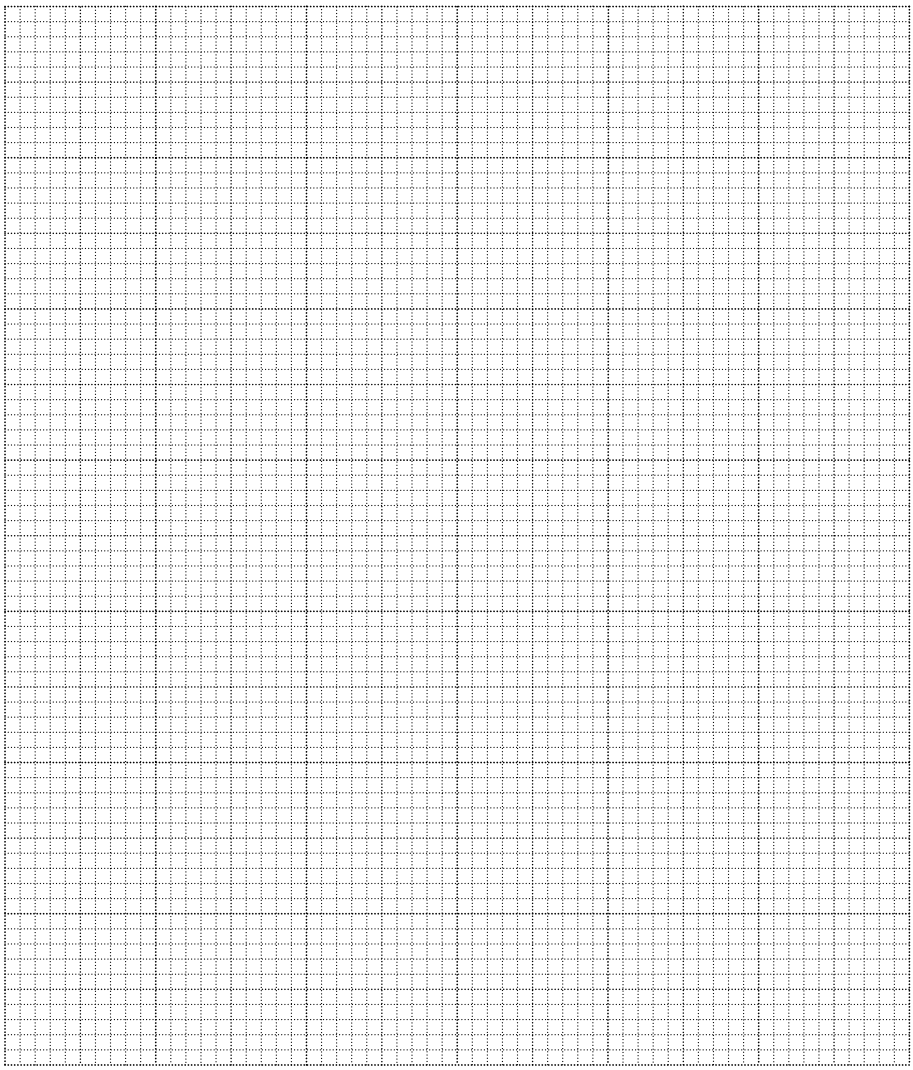
22 In an experiment, it is thought that x and y are connected by a formula of the type

$$y=\frac{a}{x^2}+b.$$

Some values of x and y are given in the following table.

x	1	2	3
y	21	$7\frac{1}{2}$	5

By drawing a suitable graph, find the values of a and b.



[2]

$a =$ _____ [1]

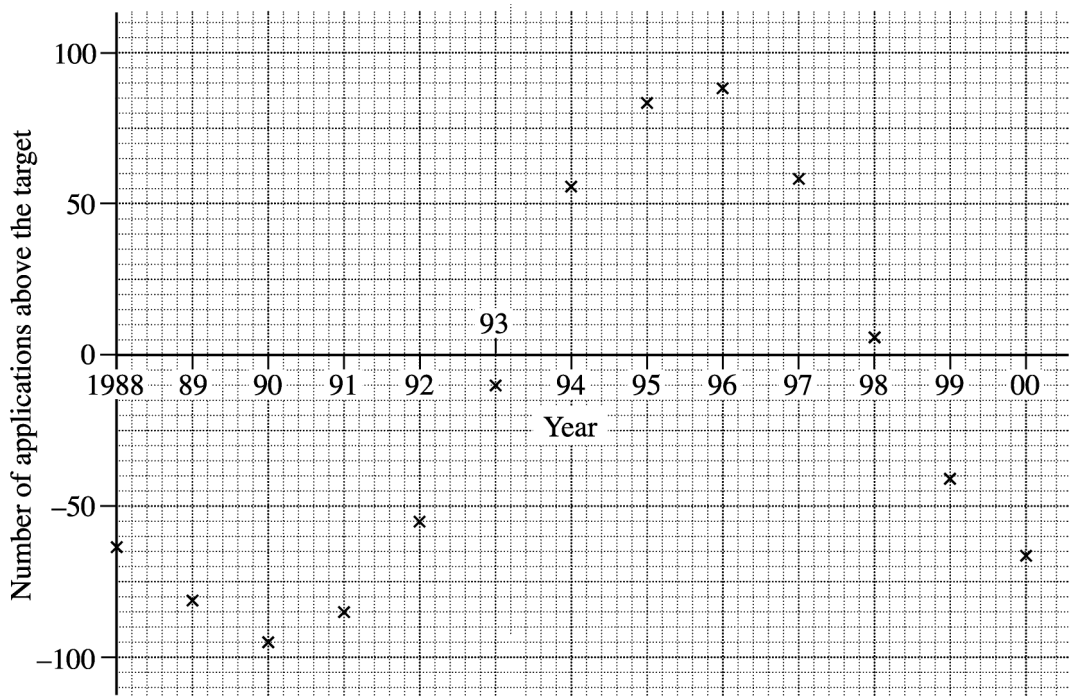
$b =$ _____ [1]

4

23 An American medical college keeps a record of the number of applications it receives each year.

It has a target of 350 applications per year.

This diagram shows the number of applications above or below the target.



(a) Use the diagram to complete these statements.

The **next** year that applications will begin increasing will be _____ [1]

The **next** year that applications will be greater than the target will be _____ [1]

The expected number of applications in the year 2001 is _____ [1]

(b) The data can be modelled as

$$n = -p\cos(qt)$$

where n = the number of applications,
t = the time in years, with 1990 as year 0,
and p and q are constants.

Find approximate values for p and q.

(b) p = _____ [1]

q = _____ [1]

5

RECOGNISING ACHIEVEMENT

Oxford Cambridge and RSA Examinations

General Certificate of Secondary Education

Mathematics C (Graduated Assessment) 1966/2343(H)

HIGHER TIER TERMINAL PAPER

MARK SCHEME

Specimen Paper 2003

SECTION A

1	**(a)**	33.5	W1	
		34.5	W1	Accept 14.499…
	(b)	103.497 to 103.5	W1	
	(c)(i)	$5.5 < m$ or $m < 6.5$	W1	For either or for $5.5 < m < 6.5$
	(ii)	5.5 (and) 6.5	W1	For both
			[5]	
2	**(a)**	$6x + 3 - 2x + 2$	M1	
		$4x + 5$	A1	Or W2 $4x + 5$
	(b)	$A - \pi r^2 = 2\pi rh$	M1	
		$h = \frac{A - \pi r^2}{2\pi r}$	A1	Or W2 for correct answer
			[4]	
3	**(a)**	Six points plotted ± 1mm	P2	P1 for 4 correct
		Smooth curve or line segments	C1	Dependent on ogive
	(b)	35.5 to 36	W1	Inclusive
			[4]	
4	**(a)(i)**	$9\frac{3}{4}$	W1	
	(ii)	$10\frac{1}{16}$	W1	
	(b)	$\frac{9}{13}$ or $\frac{91}{4}$	M1	For either
		$15\frac{3}{4}$	A1	Or W2 for $15\frac{3}{4}$
			[4]	
5	**(a)**	$\frac{2a^3b}{3}$	W2	W1 for a correct first step
	(b)	$(x + 3)(x + 4)$	M2	M1 for $(x \pm 3)(x \pm 4)$
		-3 and -4	A1	Or W3 answer only
			[5]	
6		πab	M1	
		ab = length × length = area	A1	Accept reasons why other 3 not area
			[2]	
7		$(x + 1)(x + 2) = 42$	M1	
		$x^2 + 3x - 40 = 0$	M1	
		$(x + 8)(x - 5) = 0$	M1	
		5	A1	Only
			[4]	

8		$\angle CAB + x = 90$ Tangent perp to radius $CAB + y = 90$ Angle sum triangle & angle in semi-circle	W1 W1 W1 W1 **[4]**	
9	**(a)**	6 correct points Smooth curve	W1 W1	Or M1 for at least 4 correct points
	(b)	2.4 to 2.5	W2	ft (a) M1 line $x + 3$ drawn
			[4]	
10	**(a)**	$75N = 99$ or $\frac{75}{99}$ $\frac{25}{33}$	M1 A1	
	(b)	$\frac{6+2\sqrt{12}+2}{6-2}$ $2+\sqrt{3}$	M1 A1	Accept equivalents Or W2 for $2+\sqrt{3}$
			[4]	
11	**(a)**	$\mathbf{b} - \mathbf{a}$	W1	
	(b)	$\overrightarrow{OC} = 2\mathbf{b} - \mathbf{a}$ $\overrightarrow{BC} = \mathbf{c} - \mathbf{b} = 2\mathbf{b} - \mathbf{a} - \mathbf{b}$ $\overrightarrow{BC} = \overrightarrow{AB}$	M2 M1 A1	Or M1 for $\overrightarrow{MC} = -\mathbf{a}$ seen/implied Accept equivalent methods
			[5]	
12		$x^2 + (x^2 + 12x + 36) = 50$ $x^2 + 6x - 7 = 0$ $(x + 7)(x - 1) = 0$ $x = -7, 1$ Points are $(-7, -1)$ and $(1, 7)$	M1 A1 M1 A1 A1 **[5]**	Or W4 to here For factors Ft

Section A total: 50

SECTION B

13	**(a)**	96	W1	
	(b)	78.935	W1	Accept 78.9, 79
			[2]	

14		One value between 1 and 2 correctly substituted	W1	Accept to the nearest integer or better
		An improved value substituted	W1	Accept to 1 d.p. or better
		Correct substitution of a number between 1.6 and 1.7	W1	Accept to 1 d.p. or better
		1.62	W1	Dependent on at least 2 other marks
			[4]	

15	**(a)**	0.8 seen or used	W1	
		$\sqrt{1.7^2 - 0.8^2}$ or complete trig method	M2	M1 for 1.7^2 - 0.8^2 or $\sin = \frac{0.8}{1.7}$ or $\cos = \frac{0.8}{1.7}$
		1.5	A1	Or W4 for 1.5
		$\frac{2+2.8}{2} \times 1.5$	M1	
		3.6	A1	Or W2 for 3.6
	(b)	$\tan = \frac{0.8}{1.5}$	M1	
		0.53(…)	M1	
		28(.1)	A1	Or W3 for 28(.1)
			[9]	

16		$3675.13 \div 1.07^3$	M2	Or M1 for 3434.70 or 3210
		3000	A1	Dependent on at least 1 method mark
			[3]	

17	**(a)**	$(1.1983 \times 10^8 - 1.15 \times 10^8) \div 1.15 \times 10^8$	M1	
		4 (.2)	A1	Or W2 for 4 (.2)
	(b)(i)	$6.12 \times 10^7 + 7.24 \times 10^6 + 2.16 \times 10^8$	M1	Clear intention to add
		$2.8\,(4) \times 10^8$	A1	Or W2 answer only
	(ii)	$6.12 \times 10^7 \div 213000$	M1	
		287	A1	Or W2 answer only
			[6]	

18		$\frac{12}{\sin 20} = \frac{BC}{\sin 30}$ or $\frac{AB}{\sin 130}$	M1	
		Correct expressions for BC or AB	M1	M2 if first M1 implied
		BC = 17.5 or **AB** = 26.9	A1	Or W3 to here
		BD = BC sin50 or AB sin30	M1	
		13.4(3…)	A1	Or W5 answer only
			[5]	

		Alternative scheme: BD = CD tan50 or AD tan30 CD tan50 = (CD + 12)tan30 CD = 11.27… BD = CD tan50 13.4(3…)	 M1 M1 A1 M1 A1 **[5]**	 Accept CD = BD/tan50 etc M2 if first M1 implied Or W3 to here Or W5 answer only
19		Vertical axis scaled, min two values Units: passengers(people)/year Bar heights proportional to 0.7, 1.2, 3.6, 2.1, 0.5 Bars in correct horizontal position	W1 W1 W1 W1 **[4]**	
20		$(3x + 1)(x - 2)$ $3(x^2 - 4)$ $\frac{3x+1}{3(x+2)}$	M2 M1 A1 **[4]**	M1 for $(3x \pm 1)(x \pm 2)$ Or W4 for correct answer
21	**(a)** **(b)**	$0.8 \times 0.6 + 0.2 \times 0.1$ $3 \times 0.5 \times 0.5^2$ 0.375	W2 M1 A1 **[4]**	W1 for either term
22		1, $\frac{1}{4}$, $\frac{1}{9}$ Points plotted and line drawn (a =) 18 (b =) 3	M1 M1 A1 A1 **[4]**	 Or W2 for (a =) 18 Or W2 for (b =) 3
23	**(a)** **(b)**	(20) 02/3 (20) 05/6 255 to 270 (p =) 90 to 100 (q =) 30	W1 W1 W1 W1 W1 **[5]**	

Section A total: 50

Total mark available: 100

Paper 1966 Specimen Higher Terminal

Question	Topic	NC ref	Syllabus ref	Number	Manip Alg	Other Alg	Shape	Data	UA1	UA2	UA3	Multistep	Accuracy	Units	Eff calc	Grade C	Grade B	Grade A	Grade A*	Common to 1	notes
1(a)(b)	Limits	3/4a	S8.1				3									3				3	
1(c)	Linear inequality	2/5j	A7.6		2											2					
2(a)	Expand brackets	2/5b	A6.1		2											2				2	
2(b)	Rearrangement	2/5g	A7.3		2											2				2	
3	Cum frequency	4/4a	D8.2					4									4				
4	Fractions	2/3d	N7.3	4												4					
5(a)	Simplify powers	2/5d	N8.2		2												2			2	
5(b)	Solve quadratic	2/5k	A8.2		3												3			3	
6	Dimensions	3/4a	S8.2				2				1						2				UA3:3/1F
7	Form & solve quadratic	2/5e,5k	A8.2		4												2	2			
8	Angles in circle	3/2h	S9.1				4			4		4						4			UA2:3/1e
9	Exp graph	2/6f	A9.4			4												4			
10(a)	Recurring decimal	2/2c	N10.2	2														2			
10(b)	Surd fraction	2/3n	N10.2	2															2		
11	Vectors	3/3f	S10.5				5				4	4							5		UA3:3/1f
12	Sim eqn/circle	2/5l	A10.4		5				5			5							5		
		Section A total		**8**	**20**	**4**	**14**	**4**								**13**	**13**	**12**	**12**		
13	Eff. Use calculator	2/3o	N7.1	2											2	2				2	
14	Trial & improvement	2/5m	A8.6			4									4	4				4	
15(a)	Area of trapezium, Pythagoras	3/4d,3/2f	S8.3,S6.4 S7.2				6		6			6			6	6				6	
15(b)	Trig	3/2g	S8.5				3								3		3			3	
16	Compound %	2/3k	N8.4	3											3		3				
17	Standard form	2/2b,2/3h	N8.5	6											6		6			6	
18	Sine rule	3/2g	S10.3				5		5			5			5			5			UA1:3/1a
19	Histogram	4/4q	D9.2					4		1				1				4			UA2:4/1c
20	Algebraic fractions	2/5b	A10.2		4													4			
21	Probability	4/4h,4/4g	D9.1					4		2									4		UA2:4/1c
22	Fitting data to equation	2/5h	A9.2			4													4		
23(a)	Trends in time series	4/5b	D10.2					3			3								3		UA4:1/1d
23(b)	Sine curve transformation	2/6g	A10.5		2										2				2		
		Section B total		**11**	**6**	**8**	**14**	**11**	**11**	**3**	**3**	**11**		**1**	**31**	**12**	**12**	**13**	**13**	**21**	
		Total		**19**	**26**	**12**	**28**	**15**	**16**	**7**	**8**	**24**	**0**	**1**	**31**	**25**	**25**	**25**	**25**	**33**	