OCR

RECOGNISING ACHIEVEMENT

Oxford Cambridge and RSA Examinations

General Certificate of Secondary Education

MATHEMATICS SYLLABUS A
PAPER 6
HIGHER TIER

1962/6

Specimen Paper 2003

Additional materials: Electronic calculator,
                          Geometrical instruments,
                          Tracing paper (optional).

Candidates answer on the question paper.

TIME 2 hours

Candidate Name	Centre Number	Candidate Number

INSTRUCTIONS TO CANDIDATES

- Write your name in the space above.
- Write your 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.

You are expected to use an electronic calculator for this paper.

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.

For examiner's use only

FORMULAE SHEET: HIGHER TIER

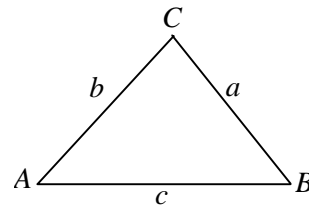**Volume of prism** = (area of cross section) × length
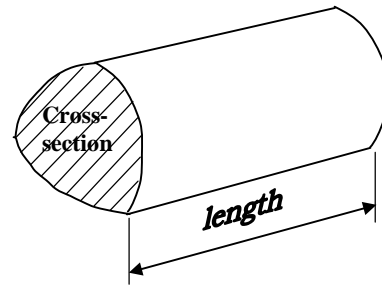
In any triangle ABC

Sine rule $\dfrac{a}{\sin A} = \dfrac{b}{\sin B} = \dfrac{c}{\sin C}$
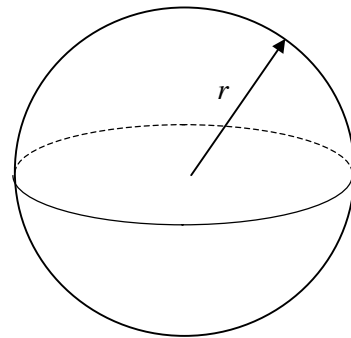
Cosine rule $a^2 = b^2 + c^2 - 2bc \cos A$
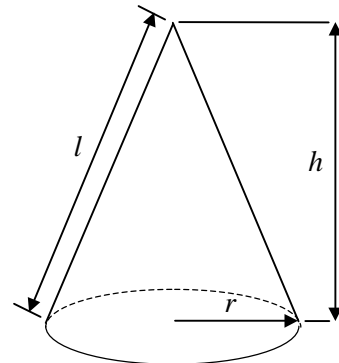
Area of triangle = $\dfrac{1}{2} ab \sin C$

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 = $\pi r l$

The Quadratic Equation

The solution of $ax^2 + bx + c = 0$ where $a \neq 0$, area given by $x = \dfrac{-b \pm \sqrt{(b^2 - 4ac)}}{2a}$
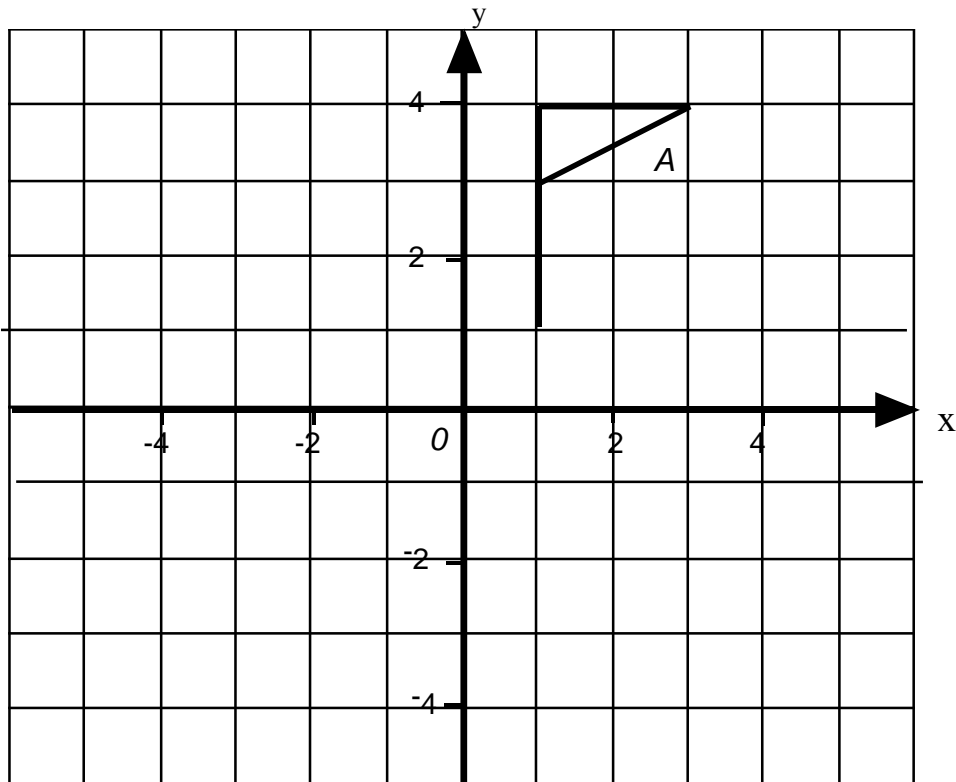
1 **(a)** Calculate $\dfrac{131.4 - 0.73}{2 - 4.5^2}$.

Answer (a) _____ **[2]**

(b) Using indices, write 1089 as a product of its prime factors.

Answer (b) _____ **[2]**

2

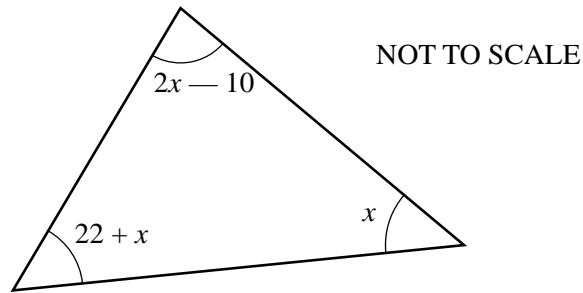**(a)** Reflect flag *A* in the line y = x. Label the image *B*. **[2]**

(b) Enlarge flag *A* with scale factor $\frac{1}{2}$ and centre (–3,2). Label the image *C*. **[2]**

3 **(a)** Form and solve an equation to calculate the angles of this triangle.

NOT TO SCALE

$2x - 10$

$22 + x$

x

Answer(a) _____ °, _____ °, _____° **[4]**

(b) Solve this inequality $x^2 < 25$.

Answer (b) _____ **[2]**

4
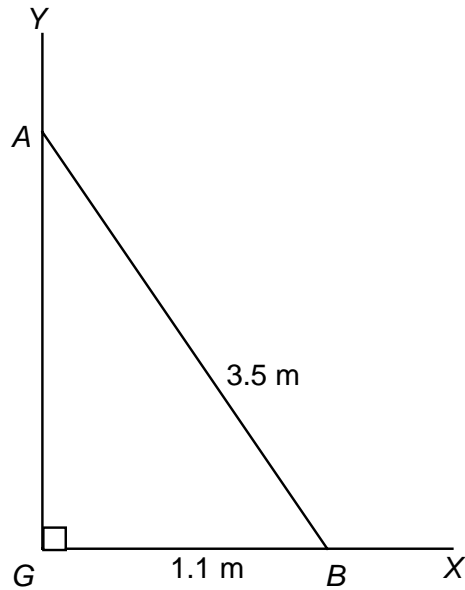
A tall vertical fence *GY* is supported by a post AB which is 3.5 m long as shown.
The foot of the post is 1.1 m from the fence on horizontal ground *XG*.

(a)   Calculate the length of *AG*.

Answer (a) _____ m **[3]**

(b)   To be safe, the post must make an angle of at least 70° with the ground.

Is this post safe? Show the calculations you make.

Answer (b) _____ **[3]**

5   The diagram shows a window formed from rectangular sections
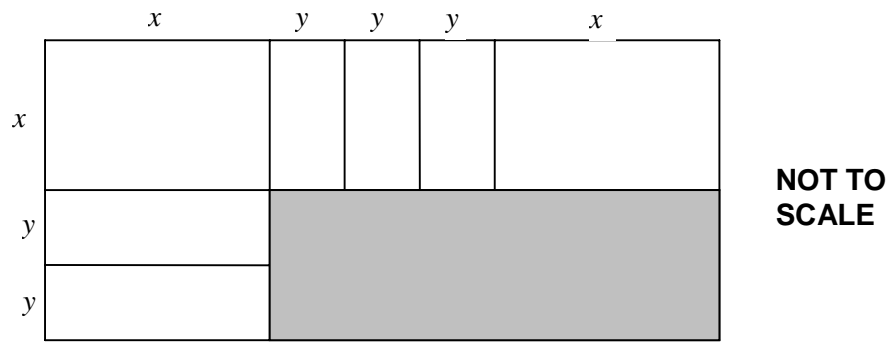
(a)   Find an expression, without brackets, for the area of the shaded section of the window.

Answer (a) _____ **[2]**

The window is 185cm long and 105cm high.

(b)   Write down a pair of equations in terms of x and y.

Answer (b) _____

[1]

(c)   Solve algebraically these simultaneous equations.

Answer (c) x= _____

_y =_ _____ **[3]**

6 Mrs Blake put £3000 in a building society account that offered 6% interest per year. Interest was added to the account at the end of each year.

(a) How much did she have in her account 3 years later, after the final interest had been added?

Answer (a) £ _____ **[3]**

(b) An annual rate of interest between 7% and 8% would be required for a sum of money to double in ten years. Use a trial and improvement method to find this rate of interest.

Give your answer as a percentage to 1 decimal place. Show your calculations.

Answer (b) _____ % **[4]**

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7 Lake Reindeer in Canada covers an area of 6.3×10^9 m^2.
Lake Michigan in the United States of America covers an area of 5.8×10^{10} m^2.
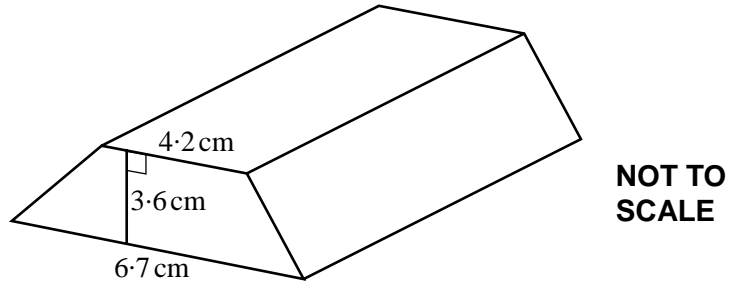
(a) What is the total area covered by these two lakes? Give your answer in standard form.

Answer (a) _____ m^2 **[2]**

(b) What is the ratio of the area of Lake Reindeer to the area of Lake Michigan?
Give your answer in the form $1:n$.

Answer (b) 1: _____ **[2]**

8 A bar of gold is a prism with volume 165 cm^3. Its cross-section is a trapezium with dimensions as shown.

4·2 cm
3·6 cm
6·7 cm

NOT TO SCALE

(a) Calculate the length of the bar of gold.

_____

_____

_____

_____

_____

_____

Answer (a) _____ cm **[3]**

(b) A similar bar of gold has a volume of 675.84 cm^3. Calculate the height of this bar of gold.

_____

_____

_____

_____

_____

_____

Answer (b) _____ cm **[3]**

(c) A different bar of gold has a volume given by the formula $V = h^2y$.
Rearrange the formula to make h the subject.

_____

_____

_____

Answer (c) _____ **[2]**

9   Watcham has a population of 86 000 in an area of 104 square miles. To meet housing targets, it needs to aim to house an extra 14 000 people whilst increasing the area by only 6 square miles.

If this happens, by how much will the population density have increased?

Answer _____ people / square mile **[4]**

10

Throw five sixes and win a holiday

(a)   What is the probability of throwing 5 sixes with one throw of the 5 ordinary dice?
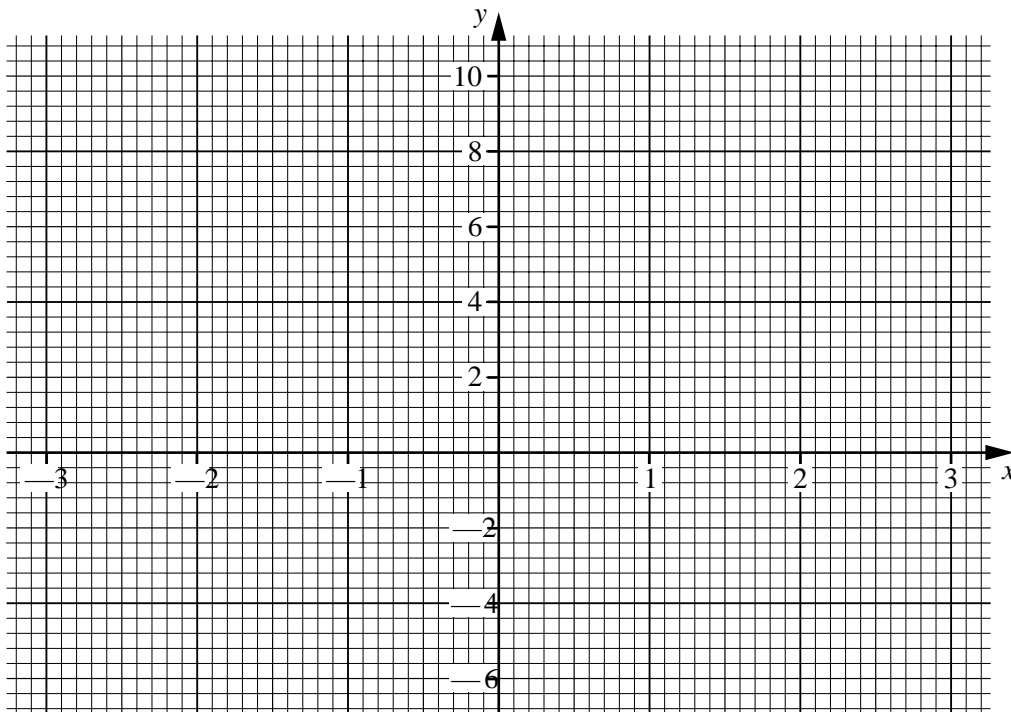
Answer (a) _____ **[2]**

(b)   The number of dice is now changed so that *n* dice are thrown.
You win a holiday if all *n* dice show sixes.
Ian throws the *n* dice once.

Write down an expression for the probability that Ian **does not** win a holiday.
Give your answer in its simplest form.

Answer (b) _____ **[2]**

11 (a) Complete this table and draw the graph of $y = x^3 - 7x + 2$ values of x from -3 to 3.

x	−3	−2	−1	0	1	2	3
y	−4	8				−4	8

[4]

(b) By drawing suitable straight lines on the graph, solve these equations:

(i) $x^3 - 7x + 2 = 3$

Answer (b)(i) x = _____ **[2]**

(ii) $x^3 - 8x + 3 = 0$

Answer (ii) x = _____ **[4]**

12
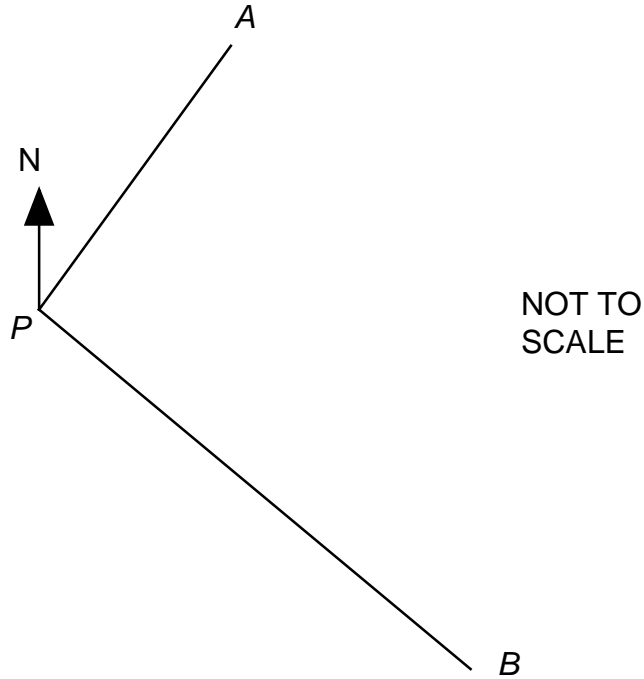
Ship *A* is 3.4 km from port *P* on a bearing of 040°.
Ship *B* is 15 km from *P* on a bearing of 155°.

(a) Calculate the distance between the two ships. Give your answer to an appropriate degree of accuracy.

_____

_____

_____

_____

_____

*Answer (a)*_____km **[3]**

(b) Calculate the bearing of ship *A* from ship *B*.

_____

_____

_____

_____

_____

_____

Answer (b) _____ ° **[4]**

13 **(a)** Simplify $2a^3 \times 4a^2$.

Answer (a) _____ **[1]**

(b) Solve the equation $x^2 - 8x + 10 = 0$.

Answer (b) _____ **[3]**

(c) Make y the subject of this formula.

$$x(2y - 3) = 5(y - 2)$$

Answer (c) _____ **[4]**

(d) Solve algebraically these simultaneous equations. Show your method clearly.

$$x + y = 5$$
$$x^2 + 3y^2 = 49$$

Answer (d) _____ **[6]**

14

NOT TO SCALE
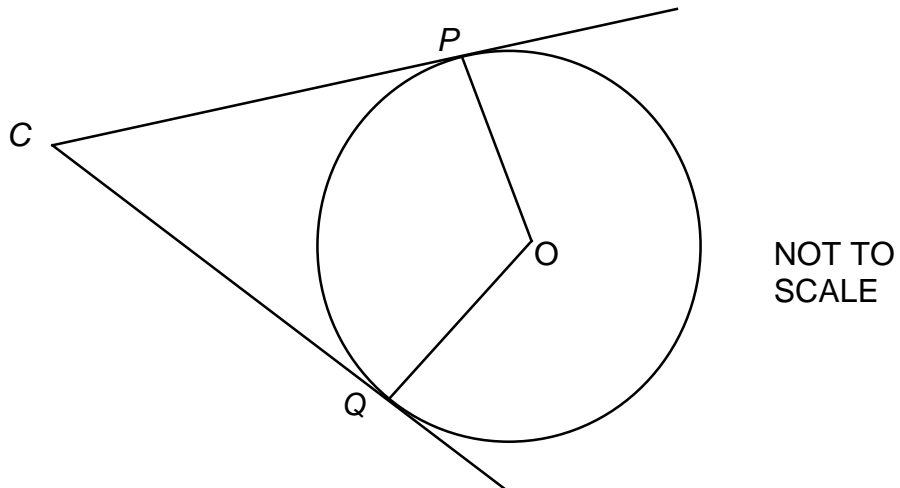
CP and *CQ* are tangents to the circle with centre *O*.

(a) Prove that triangles *CPO* and *CQO* are congruent.

_____

_____

_____

_____

_____ **[3]**

(b) Given that angle *PCQ* = 74°, calculate the reflex angle *POQ*.

_____

_____

*Answer (b)*_____° **[2]**

15 The table shows information about the ages of the members of a choir on Christmas Day.

Age in years	Number of members
$15 \le y < 20$	5
$20 \le y < 25$	18
$25 \le y < 30$	12
$30 \le y < 40$	24
$40 \le y < 50$	40
$50 \le y < 70$	36

(a) On the grid, draw a histogram to show this information. **[4]**
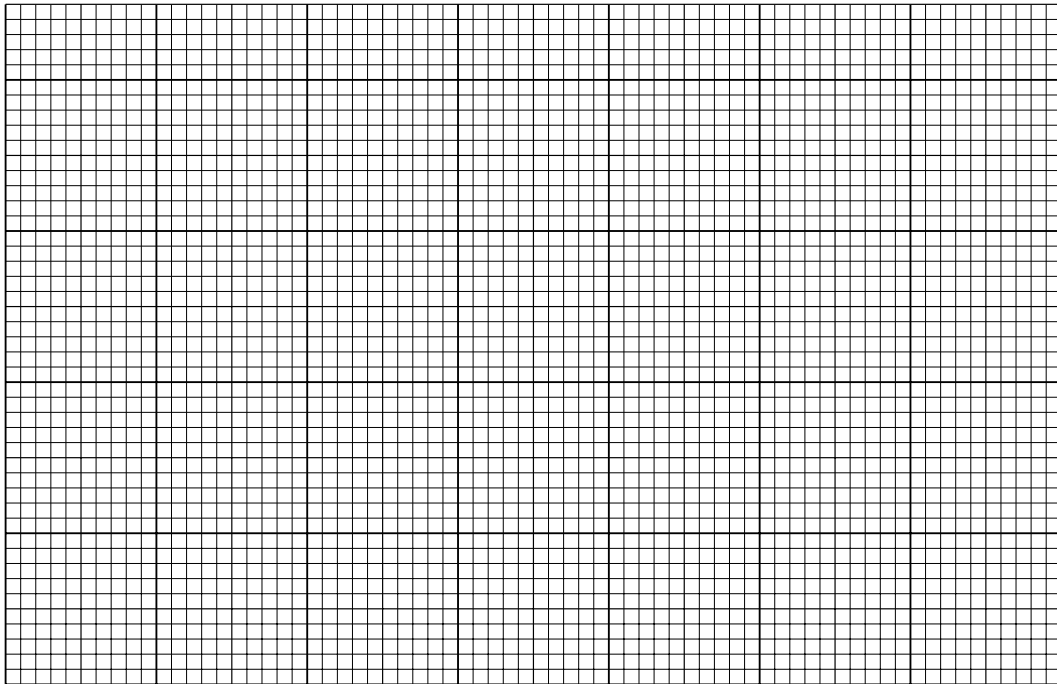
The membership of the choir remains unchanged for 2 years.

(b) Calculate an estimate of the mean age of the choir members on Christmas Day in 2 years time. Explain how you obtain this.

Answer (b) _____ years **[5]**

15 **(c)** When a new histogram of the ages of the choir members is drawn, it is noticed that it has exactly the same shape as the original one. Describe the relationship between the two histograms.

_____

_____

_____ **[2]**

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MARK SCHEME

Specimen Paper 2003

| 1 | (a) −7.16 | 2 | M1 for $130.67 \div -18.25$ | |
| | (b) 3^2 x 11^2 | 2 | M1 for 3x3x11x11 | 4 |

| 2 | (a) reflection in y = x drawn - vertices at (3,1)(4,1)(4,3) and (1,1) | 2 | M1 for line y = x drawn | |
| | (b) correct flag drawn - vertices at (0,3) (-1,3) (-1,2.5) and (-1,1.5) | 2 | M1 for flag correct size in wrong position | 4 |

3	(a) $4x + 12 = 180$	M1	may be unsimplified	
	$4x = 168$ or $x + 3 = 45$	M1		
	$x = 42$	A1		
	other angles 64, 74	A1		4
	(b) $-5 < x < 5$	2	B1 for $x < 5$ **or** $x > $ -5 **or** $-5 = x = 5$	

4	(a) 3.3(2...)	3	M2 for $\sqrt{(3.5^2 - 1.1^2)}$ or M1 for $1.1^2 + h^2 = 3.5^2$ or better	
	(b) cos ø = 1.1 / 3.5 or 0.314..	M1		
	inv cos used	M1		
	ø = 71(.6...)	A1		
	or 3.5 x cos 70°	M1		
	= 1.1(97..)	M1		6
	so ladder is safe	A1		

5	(a) $6y^2+2xy$	2	M1 for $2y(3y+x)$ Allow omission of brackets	
	(b) $x+2y = 105$; $2x+3y = 185$	1		
	(c) $x = 55$ $y = 25$	3	M1 for multiplying and subtracting oe. and A1 for one correct value	6

6	(a) 3573.04 or 3573.05	3	M2 for 3000×1.06^3 or M1 for evidence of at least two years totals (3180 and 3370.8(0))	
	(b) trial between 7 and 8%	M1		
	trials of 7.1 and 7.2% or better	M1		
	trial of 7.15% or better	M1		
	answer 7.2%	1		7

5	1.6289		7.1	1.9856135
6	1.7908		7.2	2.0042314
7	1.9672		7.3	2.0230062
8	2.1589		7.4	2.0419392
9	2.3674		7.5	2.0610316
10	2.5937		7.6	2.0802844
			7.7	2.099699
7.15	1.9949		7.8	2.1192764
			7.9	2.139018

| 7 | (a) $6.4(3) \times 10^{10}$ | 2 | B1 for correct answer with poor notation | |
| | (b) $9.2(06..)$ | 2 | M1 for $(5.8 \times 10^{10}) \div (6.3 \times 10^9)$ | 4 |

8	(a) 8.4	3	M1 for Area of trap. = 19.6(2) M1 for 165 / Area of trap	
	(b) vol sf = 675.84 ÷ 165 or 4.096	M1		
	length sf = cube rt vol sf or 1.6	M1		
	3.6 x their length s.f	A1		6
	5.76 or 5.8			
	(c) $\sqrt{\dfrac{V}{y}}$	2	M1 for $h^2 = \dfrac{V}{y}$	

| 9 | $82(.19..)$ | 4 | M1 for 86000/104 or 826(.9..)
 M1 for 100000/110 or 909.(09..)
 M1 for subtraction of these | 4 |

| 10 | (a) 1/7776 or 1.286×10^{-4} or equivalent | 2 | M1 for $(1/6)^5$ | |
| | (b) $1 - (1/6)^n$ | 2 | M1 for $(1/6)^n$ seen | 4 |

11	(a) 8, 2, –4	1		
	pts plotted	1		
	general shape correct	1		
	smooth curve	1		
	(b) (i) 2.6 to 2.8 , -0.1 to -0.2, -2.5 to -2.6	2	1 for 2 correct	
	(ii) $y = x - 1$ drawn	M2	M1 for attempted rearrangement of	
	-3, 0.3 to 0.4, 2.5 to 2.7	A2	eqn as $x^3 - 7x + 2 = x - 1$; A1 for 2 correct solns	10

12	(a) $AB^2 = 3.4^2 + 15^2 - 2 \times 3.4 \times 15 \times \cos 115°$	M1		
	$= 279.66....$	A1		
	AB = 16.7 km or 17 km	A1	accept 2 sf if method seen	
	(b) where ø is acute angle made by AB with N:			
	AB cos ø = 3.4 cos 40° + 15 cos 25°	M2	or e.g. AB sin ø = 15 cos 65° - 3.4 cos 50°	
	ø = 14.3(8..)	A1		
	Bearing = 346°	A1	accept to more s.f.; implies previous A1	7

13	**(a)** $8a^5$	1	
	(b) $4\pm\sqrt{6}$ or 6.4(49..) and 1.55..	3	M1 for subst. in quadratic formula or for $x-4 = (\pm)\sqrt{6}$ or $(x-4)^2 = 6$

(c)

$2xy - 3x = 5y - 10$	M1	
$2xy - 5y = 3x - 10$	M1	or negative equivalent
LHS $= y(2x-5)$	M1	
$y = \dfrac{3x-10}{2x-5}$ or equivalent	A1	

(d)

$(5-y)^2 + 3y^2 = 49$	M1	or $x^2 + 3(5-x)^2 = 49$
$25 - 10y + y^2 + 3y^2 = 49$	M1	or $x^2 + 3(25 - 10x + x^2) = 49$
$4y^2 - 10y - 24 = 0$	A1	or $4x^2 - 30x + 26 = 0$
$(2y+3)(y-4) = 0$	M1	or $(2x - 13)(x - 1) = 0$
$y = 4$ or -1.5	A1	
$x = 1$ or 6.5	A1	**14**

14	**(a)** OP = OQ [radii]	1	
	CPO = CQO = 90° [angle between tgt and radius]	1	
	CO is common	1	
	(b) 254°	2	M1 for POQ (obtuse) = 180 - 74° **5**

15	**(a)** axes graduated and labelled with age and frequency density [or area scale shown]	1	
	members per year: 1, 3.6, 2.4, 2.4, 4, 1.8	1	or may be per 10 years etc
	group widths correct	1	
	heights of bars correct	1	ft their freq density
	(b) mean = 43.6(48..)	5	M1 for midpts used: 17.5, 22.5, 27.5, 35, 45, 60; M1 for midpts x freq; M1 for division by 135, M1 for mean + 2; or M2 for 19.5, 24.5 etc used as midpts, M2 for evidence of correct use of statistical fns of calculator
	(c) will be a translation of 2 years to right, with groups $17 \le y < 22$ etc or good full attempt at calculating numbers in existing groups in two years time and relating to shape	2	1 for partially correct description [list of examples would be supplied to examiners] **11**

Total   100

1962 Analysis
Paper: 6   Year: Specimen 2003   Target grades   AO 1

Qn	NC ref	Topic	Context	Nu	Man Alg	Non Man Alg	SS	HD	C	B	A	A*	M/S	Com F/I	Com I/H	Str 1	Str 2	Str 3	Notes
1	2.3o 2.3a	Calc efficiency; prime factors		4					4										(b) possibly worth 1 more
2	3.3b 3.3c	Transformations	Flag				4		4										
3	2.5e 2.5j	Form and solve eqns/Inequality	Triangle		6				4	2									
4	3.2f 3.2g	Pythagoras' Theorem/ Trigonometry	Fence support				6		3	3					6			3	paper 4 qn 11a
5	2.5b 2.5i	Equations / expansion			6				6						6		2		paper 4 qn 12
6	2.3k 2.3t	Compound interest	savings	7					3		4		3		3	3			paper 4 qn 13 + extra part
7	2.3m 2.3r 2.4a	Standard form	lakes	4						4					4				paper 4 qn 14
8	3.4d 3.3d 2.5g	Volumes	trap. prism; similar shapes		2		6			5		3	3		5	3			paper 4 qn 15 + extra part
9	2.4a	Compound measures	population density	4						4			4		4	4			paper 4 qn 16
10	4.4g	Probability	Win a holiday					4			2	2					2		
11	2.6f 2.6e	Cubic graph + graphical soln of eqns			2	8				6		4			4				paper 4 qn 17a + extra parts; part (c) links two criteria as may be expected at A*
12	3.2g	Sine and cosine rule	ships				7				3	4	4			4			

#	Spec	Description	Nu	Man Alg	Non Man Alg	SS	HD					M/S	Com F/I	Com I/H	Str 1	Str 2	Str 3	Notes
13	2.5b 2.5k 2.5g 2.5l	Indices; quadratics + simultaneous equations	14					1		3	10							
14	3.2e 3.2h	Congruency / angles in circle				5				5							3		
15	4.4a 4.4j	Histogram / mean Choir					11		9	2		5				2	2	
		Totals for paper:	19	30	8	28	15	25	24	26	25	19	0	32	14	6	8	
		Totals for tier:																
		Target totals for paper	Nu	Man Alg	Non Man Alg	SS	HD					M/S	Com F/I	Com I/H	Str 1	Str 2	Str 3	
		Fdn	38			28	15	34	22	22	22							
		Inter	28			28	15	25	25	25	25							
		Higher	19			28	15	25	25	25	25							
		Target totals for tier																
		Fdn		n/a								10_13			8	8	8	minimum of 25 AO1 per tier; 8 per strand
		Inter		35-40								15-20			8	8	8	minimum of 25 AO1 per tier; 8 per strand
		Higher		50								20-25			8	8	8	minimum of 25 AO1 per tier; 8 per strand