RECOGNISING ACHIEVEMENT

FREE-STANDING MATHEMATICS QUALIFICATION
Advanced Level

ADDITIONAL MATHEMATICS 6993/01

THURSDAY 14 JUNE 2007

Afternoon
Time: 2 hours

Additional materials:
Answer booklet (16 pages)
Graph paper

INSTRUCTIONS TO CANDIDATES

- Write your name, centre number and candidate number in the spaces provided on the answer booklet.
- Answer **all** the questions.
- You are permitted to use a scientific or graphical calculator in this paper.
- Final answers should be given correct to three significant figures where appropriate.

INFORMATION FOR CANDIDATES

- The number of marks is given in brackets [ ] at the end of each question or part question.
- The total number of marks for this paper is 100.

ADVICE TO CANDIDATES

- Read each question carefully and make sure you know what you have to do before starting your answer.
- You are advised that an answer may receive **no marks** unless you show sufficient detail of the working to indicate that a correct method is being used.

This document consists of **7** printed pages and **1** blank page.

Section A

1 Solve the inequality $3(x+2) > 2 - x$. [3]

2 A particle moves in a straight line. Its velocity, $v\,\mathrm{m\,s^{-1}}$, t seconds after passing a point O is given by the equation

$$v = 6 + 3t^2.$$

Find the distance travelled between the times $t = 1$ and $t = 3$. [4]

3 A circle has equation $x^2 + y^2 - 4x - 6y + 3 = 0$.

Find the coordinates of the centre and the radius of the circle. [3]

4 Find all the values of x in the range $0° < x < 360°$ that satisfy $\sin x = -4\cos x$. [5]

5 A car is travelling along a motorway at $30\,\mathrm{m\,s^{-1}}$. At the moment that it passes a point A the brakes are applied so that the car decelerates with constant deceleration. When it reaches a point B, where AB = 300 m, the speed of the car is $10\,\mathrm{m\,s^{-1}}$.

Calculate

(i) the constant deceleration, [3]

(ii) the time taken to travel from A to B. [2]

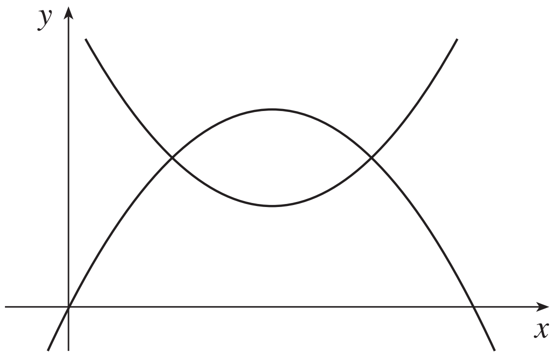
6 Find the equation of the tangent to the curve $y = x^3 - 3x + 4$ at the point $(2, 6)$. [4]

7 Use calculus to find the x-coordinate of the minimum point on the curve

$$y = x^3 - 2x^2 - 15x + 30.$$

Show your working clearly, giving the reasons for your answer. [7]

8 The figure shows the graphs of $y = 4x - x^2$ and $y = x^2 - 4x + 6$.



(i) Use an algebraic method to find the x-coordinates of the points where the curves intersect. [3]

(ii) Calculate the area enclosed by the two curves. [4]

9 The points A, B and C have coordinates $(-1, 1)$, $(5, 8)$ and $(8, 3)$ respectively.

(i) Show that AC = AB. [2]

(ii) Write down the coordinates of M, the midpoint of BC. [1]

(iii) Show that the lines BC and AM are perpendicular. [2]

(iv) Find the equation of the line AM. [2]

10 **(i)** By drawing suitable graphs on the same axes, indicate the region for which the following inequalities hold. You should shade the region which is **not** required.

$$\begin{aligned} 2x + 3y &\leqslant 12 \\ 2x + y &\leqslant 8 \\ y &\geqslant 0 \\ x &\geqslant 0 \end{aligned}$$

[5]

(ii) Find the maximum value of $x + 3y$ subject to these conditions. [2]

Section B

11 **(a)** You are given that $f(x) = x^3 - 3x^2 - 4x$.

(i) Find the three points where the curve $y = f(x)$ cuts the x-axis. [4]

(ii) Sketch the graph of $y = f(x)$. [1]

(b) You are given that $g(x) = x^3 - 3x^2 - 4x + 12$.

(i) Find the remainder when $g(x)$ is divided by $(x + 1)$. [2]

(ii) Show that $(x - 2)$ is a factor of $g(x)$. [1]

(iii) Hence solve the equation $g(x) = 0$. [4]

12 The work-force of a large company is made up of males and females in the ratio 9 : 11. One third of the male employees work part-time and one half of the female employees work part-time.

8 employees are chosen at random.

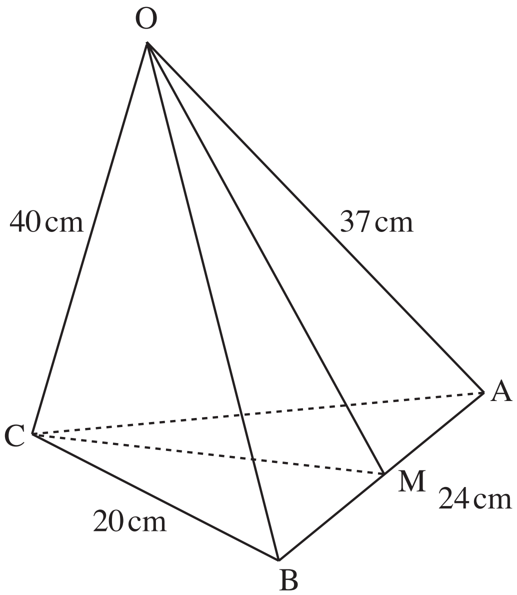
Find the probability that

(i) all are males, [2]

(ii) exactly 5 are females, [4]

(iii) at least 2 work part-time. [6]

13 In the pyramid OABC, OA = OB = 37 cm, OC = 40 cm, CA = CB = 20 cm and AB = 24 cm. M is the midpoint of AB.



Calculate

(i) the lengths OM and CM, [3]

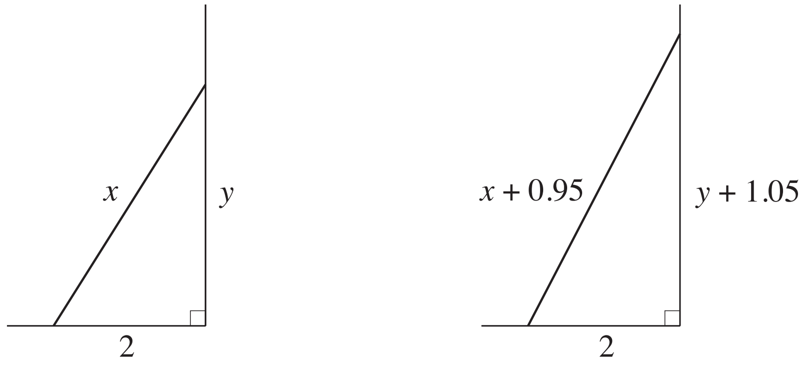
(ii) the angle between the line OC and the plane ABC, [4]

(iii) the volume of the pyramid. [5]

[The volume of a pyramid $= \frac{1}{3} \times$ base area $\times$ height.]

[Question 14 is printed overleaf.]

14 An extending ladder has two positions. In position **A** the length of the ladder is x metres and, when the foot of the ladder is placed 2 metres from the base of a vertical wall, the ladder reaches y metres up the wall.



Position A **Position B**

In position B the ladder is extended by 0.95 metres and it reaches an extra 1.05 metres up the wall.

The foot of the ladder remains 2 m from the base of the wall.

(i) Use Pythagoras' theorem for position **A** and position **B** to write down two equations in x and y. [2]

(ii) Hence show that $2.1y = 1.9x - 0.2$. [3]

(iii) Using these equations, form a quadratic equation in x.

Hence find the values of x and y. [7]

BLANK PAGE

RECOGNISING ACHIEVEMENT

FSMQ

Additional Mathematics

ADVANCED FSMQ **6993**

Mark Scheme for the Unit

June 2007

6993/MS/R/07

Oxford Cambridge and RSA Examinations

OCR (Oxford, Cambridge and RSA Examinations) is a unitary awarding body, established by the University of Cambridge Local Examinations Syndicate and the RSA Examinations Board in January 1998. OCR provides a full range of GCSE, A level, GNVQ, Key Skills and other qualifications for schools and colleges in the United Kingdom, including those previously provided by MEG and OCEAC. It is also responsible for developing new syllabuses to meet national requirements and the needs of students and teachers.

This mark scheme is published as an aid to teachers and students, to indicate the requirements of the examination. It shows the basis on which marks were awarded by Examiners. It does not indicate the details of the discussions which took place at an Examiners' meeting before marking commenced.

All Examiners are instructed that alternative correct answers and unexpected approaches in candidates' scripts must be given marks that fairly reflect the relevant knowledge and skills demonstrated.

Mark schemes should be read in conjunction with the published question papers and the Report on the Examination.

OCR will not enter into any discussion or correspondence in connection with this mark scheme.

Any enquiries about publications should be addressed to:

OCR Publications
PO Box 5050
Annesley
NOTTINGHAM
NG15 0DL

Telephone: 0870 870 6622
Facsimile: 0870 870 6621
E-mail: publications@ocr.org.uk

CONTENTS

Additional Mathematics FSMQ (6993)

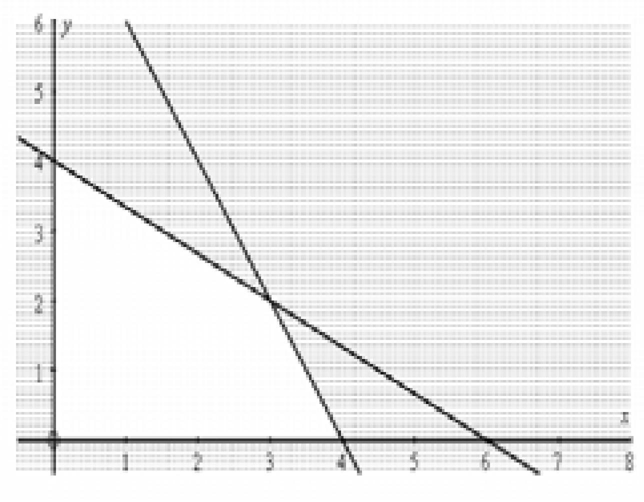
MARK SCHEME FOR THE UNIT

Mark Scheme 6993
June 2007

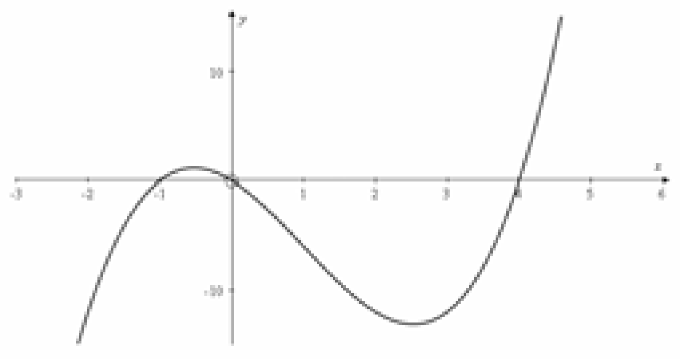
Q.		Answer	Mark	Notes
Section A				
1		$3(x+2)>2-x$ $\Rightarrow 3x+6>2-x$ $\Rightarrow 4x>-4$ $\Rightarrow x>-1$	M1 A1 A1 **3**	Expand and collect Only 2 terms
2		$v=6+3t^2 \Rightarrow s=6t+t^3+c$ Take $s=0$ when $t=1 \Rightarrow c=-7$ When $t=3,\ s=18+27-7=38$ Alternatively: $s=\int_1^3 \left(6+3t^2\right)\mathrm{d}t=\left[6t+t^3\right]_1^3=\left(18+27\right)-\left(6+1\right)=38$	M1 A1 DM1 A1 **4**	Ignore *c* Either sub to find *c* or sub and subtract from definite integral M1 int A1 DM1 sub and sub A1
3		$x^2+y^2-4x-6y+3=0$ $\Rightarrow x^2-4x+y^2-6y=-3$ $\Rightarrow x^2-4x+4+y^2-6y+9=4+9-3$ $\Rightarrow \left(x-2\right)^2+\left(y-3\right)^2=10$ $\Rightarrow$ Centre (2, 3), radius $\sqrt{10}$ $(\approx 3.162...)$ SC: Penultimate line M1 A1 S.C. Centre B1 Find a point on the circle and then use Pythagoras M1 to find radius A1	M1 B1 A1 **3**	Complete the square Centre Radius *Accept correct answers with no working*
4		$\sin x=-4\cos x \Rightarrow \tan x=-4$ $\Rightarrow x=\pm 75.96^0$ $\Rightarrow x=180-75.96=104^0$ and $x=360-75.96=284^0$ Alternatively Use of $s^2+c^2=1$ M1 $\Rightarrow \cos^2 x=\frac{1}{17}$ $\Rightarrow x=\pm 75.96^0$ A1 $\Rightarrow x=180-75.96=104^0$ M1 A1 and $x=360-75.96=284^0$ A1 S.C. Graphical method $\pm 2^0$ tolerance B1 B1 S.C. Answers with no working B1 for both.	B1 B1 M1 A1 A1 **5**	 For either value from calculator For method to find a correct answer from that given on calculator -1 extra values Ignore values outside 360^0

5	(i)	Using $v^2 = u^2 + 2as$ $\Rightarrow 10^2 = 30^2 + 2a.300$ $\Rightarrow 600a = -800$ $\Rightarrow a = -\frac{4}{3}$	M1 A1 A1 **3**	Got to be used! *Ignore –ve sign.*
	(ii)	Using $v = u + at$ $\Rightarrow 10 = 30 - \frac{4}{3}t$ $\Rightarrow t = 20 \times \frac{3}{4} = 15$ Or: $s = \frac{u+v}{2}t$ $\Rightarrow 300 = \frac{30+10}{2}t$ $\Rightarrow t = \frac{600}{40} = 15$	M1 F1 **2**	 From their *a* This could be used in (i) to find *t* then *a*
6		$\frac{dy}{dx} = 3x^2 - 3$ At (2, 6) $\frac{dy}{dx} = 9 \Rightarrow y - 6 = 9(x-2)$ $\Rightarrow y = 9x - 12$	B1 M1 DM1 A1 **4**	Diff correctly Substitute in their gradient function Set up equation with their gradient
7		$\frac{dy}{dx} = 3x^2 - 4x - 15$ $= 0$ when $3x^2 - 4x - 15 = 0$ $\Rightarrow (3x+5)(x-3) = 0$ $\Rightarrow x = 3, -\frac{5}{3}$ $\frac{d^2y}{dx^2} = 6x - 4$: When $x = 3$, $\frac{d^2y}{dx^2} > 0$ $\Rightarrow$ minimum $\Rightarrow x = 3$ N.B. Any valid method is acceptable, but not that *x* = 3 is the right hand value or that the *y* value is lower then for the other value of *x*.	M1 A1 M1 A1 M1 F1 A1 **7**	 =0 and attempt to solve Differentiate again and substitute Providing all other marks earned

8	(i)	$4x-x^2=x^2-4x+6$ $\Rightarrow 2x^2-8x+6=0$ $\Rightarrow x^2-4x+3=0$ $\Rightarrow (x-3)(x-1)=0$ $\Rightarrow x=3,1$	M1 M1 A1 **3**	Equate and attempt to collect terms Solve a quadratic Ans only seen - B1
	(ii)	Area = $\int_1^3\left(4x-x^2\right)dx-\int_1^3\left(x^2-4x+6\right)dx$ $=\left[2x^2-\frac{x^3}{3}\right]_1^3-\left[\frac{x^3}{3}-2x^2+6x\right]_1^3$ $=(18-9)-\left(2-\frac{1}{3}\right)-(9-18+18)+\left(\frac{1}{3}-2+6\right)$ $=9-1\frac{2}{3}-9+4\frac{1}{3}=2\frac{2}{3}$ Alternatively: Area = $\int_1^3\left(8x-2x^2-6\right)dx$ $=\left[4x^2-\frac{2x^3}{3}-6x\right]_1^3$ $=(36-18-18)-\left(4-\frac{2}{3}-6\right)=0-\left(-2\frac{2}{3}\right)$ $=2\frac{2}{3}$	M1 A1 DM1 A1 **4**	Integrate All terms; condone one slip Substitute and subtract (even if limits wrong) M1 integrate A1 DM1 sub and sub A1
9	(i)	AB = $\sqrt{(5--1)^2+(8-1)^2}=\sqrt{85}$ AC = $\sqrt{(8--1)^2+(3-1)^2}=\sqrt{85}$	M1 A1 **2**	For sight of Pythagoras used at least once
	(ii)	M = $\left(\frac{5+8}{2},\frac{8+3}{2}\right)=\left(\frac{13}{2},\frac{11}{2}\right)$	B1 **1**	
	(iii)	Grad BC = $\frac{8-3}{5-8}=-\frac{5}{3}$ Grad AM = $\frac{11/2-1}{13/2+1}=\frac{9/2}{15/2}=\frac{9}{15}=\frac{3}{5}$ $\Rightarrow m_1.m_2=-\frac{5}{3}.\frac{3}{5}=-1$ Allow a geometric argument with reference to M being midpoint and the triangle isosceles.	E1 B1 **2**	Both gradients; AM ft from their M Both and demonstration
	(iv)	$y-1=\frac{3}{5}(x+1)$ $\Rightarrow 5y=3x+8$	M1 A1 **2**	Must use (−1, 1) or their M and their g

10	**(i)**	 N.B. -1 no scales	B1 E1 B1 E1 B1 **5**	One line Shading 2^{nd} line Shading Other two lines and shading
	(ii)	Maximum value on *y*-axis (0, 4) giving 12	B1 B1 **2**	Allow B2 for 12

Section B

11	**(a)(i)**	$x^3 - 3x^2 - 4x = 0$ $\Rightarrow x\left(x^2 - 3x - 4\right) = 0$ $\Rightarrow x(x-4)(x+1) = 0$ $\Rightarrow x = 0, -1, 4$ S.C. just answers B2	M1 A1 A1 A1 **4**	Accept any valid method
	(ii)	 Must have points on axes	B1 **1**	
	(b)(i)	Remainder theorem or long division G(–1) = 12	M1 A1 **2**	For sub –1
	(ii)	g(2) = 0	B1 **1**	For sub x = 2
	(iii)	By continued trial or by division and quadratic factorisation $g(3) = 0,\ g(-2) = 0$ $\Rightarrow x = 2, 3, -2$ S.C. just answers B2 Alternatively: By division by (x – 2) and quadratic factorisation M1 (x – 2)(x^2 – x – 6) = 0 A1 ⇒(x – 2)(x + 2)(x – 3) = 0 A1 ⇒x = 2, –2, 3. A1	M1 A1 A1 A1 **4**	 3 –2 Final answer

12	**(i)**	P(All males) = $\left(\frac{9}{20}\right)^8 = 0.00168$	M1 A1 **2**	
	(ii)	P(5 females) = $^8C_5\left(\frac{9}{20}\right)^3\left(\frac{11}{20}\right)^5$ $= 0.2568 \approx 0.257$	M1 M1 A1 A1 **4**	powers coefficient 56 (could be implied)
	(iii)	P(full-time) = $\frac{23}{40}$ $\left(\text{Or P(PT)} = \frac{17}{40}\right)$ P(at least two part-time) = 1 − P(all FT) − P(7FT,1PT) $= 1 - \left(\frac{23}{40}\right)^8 - 8\left(\frac{23}{40}\right)^7\left(\frac{17}{40}\right)$ $= 1 - 0.0119 - 0.0706 = 0.917$ Alternatively: Add 7 terms M1 $28\left(\frac{23}{40}\right)^6\left(\frac{17}{40}\right)^2 + \ldots\ldots\left(\frac{17}{40}\right)^8$ A1 powers A1 Coeffs $= 0.917$ A1 Ans S.C. Read "At least two" as "exactly two" $28\left(\frac{23}{40}\right)^6\left(\frac{17}{40}\right)^2 = 28 \times 0.00653 = 0.1828$ B1	M1 A1 M1 A1 A1 A1 **6**	probability 1–2correct terms Powers coefficient Ans

13	**(i)**	Pythagoras: $OM^2 = 37^2 - 12^2 \Rightarrow OM = 35$ $CM^2 = 20^2 - 12^2 \Rightarrow CM = 16$	M1 A1 A1 **3**	Correct use of Pythagoras for at least one
	(ii)	Use cosine rule on triangle OCM $\Rightarrow \cos C = \frac{16^2 + 40^2 - 35^2}{2 \times 16 \times 40} \Rightarrow C = 60.5^0$	M1 M1 A1 A1 **4**	Correct angle Correct use of cosine formula Ans
	(iii)	Sight of attempt to find base area Area = $\frac{1}{2} \times 16 \times 24 = 192$ Sight of attempt to find height $h = 40 \sin 60.5 = 34.8$ $\Rightarrow$ Volume = $\frac{1}{3} \times 192 \times 34.8 = 2228 \ \approx 2230\text{cm}^3$	M1 A1 M1 A1 A1 **5**	 Can be implied Can be implied

14	**(i)**	Apply Pythagoras to both triangles: $x^2 = y^2 + 4$ $(x + 0.95)^2 = (y + 1.05)^2 + 4$	 B1 B1 **2**	
	(ii)	Subtract: $2\times0.95x + 0.95^2 = 2\times1.05y + 1.05^2$ $\Rightarrow 2.1y = 1.9x - (1.05^2 - 0.95^2)$ $\Rightarrow 2.1y = 1.9x - 0.2$ Alternatively: Multiply out one of the brackets B1 Substitute for y^2 M1 Correct result A1	M1 A1 A1 **3**	
	(iii)	Substitute for y: $x^2 = \left(\frac{1.9x - 0.2}{2.1}\right)^2 + 4$ $\Rightarrow 2.1^2x^2 = 1.9^2x^2 - 2\times0.2\times1.9x + 0.2^2 + 4\times2.1^2$ $\Rightarrow 0.8x^2 + 0.76x - 17.68 = 0$ $\Rightarrow x = \frac{-0.76 \pm \sqrt{0.76^2 + 4\times0.8\times17.68}}{1.6} = \frac{-0.76 + 7.56}{1.6} = 4.25$ Substitute : $y = \left(\frac{1.9x - 0.2}{2.1}\right) = 3.75$ Withhold last mark if more than one answer given The quadratic in y is $20y^2 + 21y - 360 = 0$ Integer coefficients for x equation gives $20x^2 + 19x - 442 = 0$	M1 M1 A1 DM1 A1 DM1 F1 **7**	Get y as subject Sub expression for y Correct quadratic Solve Ignore other root

FSMQ Advanced Additional Mathematics 6993
June 2007 Assessment Session

Unit Threshold Marks

Unit	**Maximum Mark**	**A**	**B**	**C**	**D**	**E**	**U**
6993	100	70	60	50	40	30	0

The cumulative percentage of candidates awarded each grade was as follows:

	A	**B**	**C**	**D**	**E**	**U**	**Total Number of Candidates**
6993	28.8	38.6	48.1	57.5	66.8	100	5500

OCR (Oxford Cambridge and RSA Examinations)
1 Hills Road
Cambridge
CB1 2EU

OCR Customer Contact Centre

(General Qualifications)
Telephone: 01223 553998
Facsimile: 01223 552627
Email: general.qualifications@ocr.org.uk

www.ocr.org.uk

For staff training purposes and as part of our quality assurance programme your call may be recorded or monitored

Oxford Cambridge and RSA Examinations
is a Company Limited by Guarantee
Registered in England
Registered Office; 1 Hills Road, Cambridge, CB1 2EU
Registered Company Number: 3484466
OCR is an exempt Charity

OCR (Oxford Cambridge and RSA Examinations)
Head office
Telephone: 01223 552552
Facsimile: 01223 552553

RECOGNISING ACHIEVEMENT

FSMQ

Additional Mathematics

ADVANCED FSMQ **6993**

Report on the Unit

June 2007

6993/MS/R/07

Any enquiries about publications should be addressed to:

OCR Publications
PO Box 5050
Annesley
NOTTINGHAM
NG15 0DL

Telephone: 0870 870 6622
Facsimile: 0870 870 6621
E-mail: publications@ocr.org.uk

CONTENTS

Additional Mathematics FSMQ (6993)

REPORT ON THE UNIT

Free Standing Mathematics Qualification, Advanced Level Additional Mathematics 6993

We can report another rise in the number of candidates sitting this examination with an entry of 5500.
I regret to say, however, that we also have to report a rise in the number of candidates who seem, from their scripts, to be entered inappropriately. The specification states that Additional Mathematics is suitable for candidates with (or are expecting to receive) a high grade at Higher level GCSE; for such candidates this specification can be used as enrichment work. When candidates do not even demonstrate an understanding of some material in the Intermediate tier and who gain a total mark in single figures we are left doubting the wisdom of their entry. One candidate even wrote on question 7 "what is calculus?"
For many candidates, the level seemed appropriate but perhaps the paper was a little long; it was evident that some strong candidates did not finish Question 14 for lack of time.

Most candidates gave their answers to an appropriate degree of accuracy, though there were still a significant minority either writing down all the digits seen on their calculator or approximating to only 2 significant figures. As in previous years, examiners deducted a mark where it was seen for the first time (and only once throughout the paper).

Section A

Q1 (Inequality)
A few could not cope with the inequality sign and replaced it with an equal sign and then tried to deduce what the answer might be at the end, rarely getting it correct. Others had difficulty with the manipulation of algebra. For the better candidates it was an easy start to the paper.

Q2 (Variable acceleration)
This defeated all but the strongest candidates. The vast majority of candidates assumed constant acceleration and tried to apply the formulae that they knew to get an answer.
Many who would otherwise have got it correct added the value for *s* at the two end points of integration rather than subtract.

Q3 (Circle)
Many knew what they were trying to obtain (and wrote down the coordinates of the centre correctly) but were once again defeated by the algebraic manipulation.
It is worth noting that $\sqrt{10}$ is the exact value of the radius and is therefore an acceptable answer. Those who wrote down an approximation were not penalised for having too many significant figures if the exact value had already been seen.

Q4 (Trigonometrical equation)
This question tested not only the identity $\frac{\sin x}{\cos x} = \tan x$ but how to identify the angles in the required range from the value given on the calculator. Strong candidates managed both; others were less than successful. We saw only rarely an effort to square and use the identity $\sin^2 x + \cos^2 x = 1$ with none totally successful.
In this case, correct to three significant figures is also correct to the nearest degree and this was the expected approximation.

Q5 Constant acceleration
Many candidates had difficulty in choosing the right formula to use and then difficulty in identifying the original and final velocities. It was of course possible, and permissible, to find the time first and then the deceleration.

Using the standard notation, $a = -\frac{4}{3}$, giving the deceleration as $\frac{4}{3}\ \mathrm{m\,s^{-2}}$. On this occasion the negative sign and the units were ignored.

Q6 Gradient function
Here the major error was to put the gradient function equal to zero; for these candidates the connection between the gradient function and the gradient of the tangent at a point was missed.

Q7 Maxima and minima
Most candidates were able to find the points where stationary values occurred, though few seemed prepared to factorise. Demonstrating that there is a minimum at $x = 3$ was acceptable in one of three ways; via the second gradient function, the magnitude of the gradient either side of $x = 3$ and the value of the function either side of $x = 3$. Simply saying that the larger value of x is the minimum because the curve is a cubic was not acceptable.

Q8 Area between two curves
Not all candidates were able to find the points of intersection of the curves. It was not necessary to identify which curve was which and so a negative value for the area was accepted. Some candidates subtracted the functions before integrating and others integrated to find the area between each curve separately and subtracting to find the answer. A very small number of able candidates found the area between one curve and the line $y = 3$ and doubled the answer – we would have liked to have given bonus marks for these candidates!

Q9 Coordinate geometry
Part (i) was usually done well, but in part (ii) candidates often halved the difference in coordinates rather than halving the sum. In part (iii) candidates were expected to demonstrate knowledge of the relationship of perpendicular gradients $m_1m_2 = -1$. To say "$m_1 = -\frac{5}{3}$, $m_2 = \frac{3}{5}$ and therefore the lines are perpendicular" is not enough. This is a case where "show that…" requires candidates to demonstrate fully their understanding and knowledge of what is being tested.
A geometric argument was accepted, though this had to be convincing. Simply to say that the triangle ABC is isosceles was not enough, though we did not expect a full proof of congruency.

Q10 Linear programming
The graph of the lines was an easy source of marks and usually candidates shaded the correct part for the two lines. Additionally in this question, candidates were required to show $x \geq 0$ and $y \geq 0$ and many missed this shading.
In part (ii) many candidates assumed that the answer was one of the vertices of their required area and worked out the value of $x + 3y$ at each, concluding correctly the value of 12. Others treated $P = x + 3y$ as an objective function and, by drawing a typical line, deduced the right answer.
A small minority shaded the quadrilateral instead of shading everywhere else.
In questions like this, it is not necessary to plot the lines on graph paper, but it is helpful to use appropriate scales – a scale on the x axis, for instance, that goes from 0 to 50 does leave the required area looking a little small!

Section B

Q11 Polynomials
Part (a) (i) required candidates to solve a cubic equation. Given that there is no constant term in the function, it was expected that at this level candidates would spot that *x* was a factor and that *x* = 0 was one of the roots. This reduces the function immediately to a quadratic. Those who did spot this completed this part of the question very easily. Others who did not spot it spent a very long time (and much more than the 4 marks would indicate was necessary) trying to find roots by the factor formula.
Part (ii) was a simple sketch; the main failure here for candidates who got the shape of the curve correct was the failure to put any scale on the axes to indicate where the curve cut the axes. Many candidates drew the curve "upside down".
Part (b) was done very much better and many candidates scored all 7 marks here with no marks for part (a).
It is worth noting that long division, carried out correctly, will always demonstrate a root or find the remainder. However, it is also worth noting that this is always very time consuming and may have contributed significantly to the fact that many failed to finish the paper. In part (b)(i), for instance, the value of g(−1) can be found in a single line, while dividing g(*x*) by (*x* + 1) takes very much longer; in this case it also introduced a further worry for candidates in that the remainder had no constant term and so it seemed as though something was missing.

Q12 Binomial Distribution
A number of candidates misread the question and set *n* = 20.
For those comfortable with this topic, the first two parts rarely produced any problems.
Finding the probability to use in (iii) caused a problem for some, as did the question to find "at least… "
A few found the remaining terms, thus expending more time than necessary; others took 1 or 3 terms from 1.
Fewer candidates expressed their answers to an inappropriate number of significant figures, but rather more only wrote their answers to 2 decimal places.
It also seemed clear to the examiners that a number of candidates had no understanding of the Binomial Distribution and some little idea of probability, given that we saw some answers greater that 1.

Q13 3-D Geometry
Part (i) was usually completed satisfactorily, though some got the terms muddled in their Pythagoras calculation. A significant number, however, worked out the wrong angle in part (ii), typically one of the other two angles in triangle OCM and rather more frequently the angle OCB. Candidates who thought that this was the angle might have been alerted to the fact that the results of part (i) were not used in this calculation and therefore might have asked themselves what was the purpose of part (i).
We have commented before that we believe that candidates would benefit from drawing the triangles in which they are carrying out a calculation. Had they done so then there would be less likelihood of getting Pythagoras wrong in part (i). Additionally some attempted to use the cosine formula in part (ii) with lengths drawn from different triangles.
To find the volume in part (iii) it was required to find the base area and the height. This defeated many, perhaps because of the multiple steps. Others took the height to be OB or OC and took the base area as $\frac{1}{2}\times 20\times 40$ - again, we wonder whether this error would have occurred had a triangle been drawn.

Q14 Algebraic manipulation
Strong candidates were not phased by the fact that there were non-integer values here. They wrote down the two equations, subtracted to obtain the linear relationship, made *y* the subject, substituted back to give a quadratic which they then solved (sometimes by factorisation!) to give exact answers for *x* and *y*. This was all completed in less than a page.
Others had less success and were let down by algebra.
The question included a "show that…" and candidates should be aware that every step must be written and convincing to obtain the marks.
Some rather startling errors were:

$x^2 = y^2 + 4 \Rightarrow x = y + 2$

$(y + 1.05)^2 = y^2 + 1.05^2$

It was also clear that the rather poor response to this question was often due to lack of time.

FSMQ Advanced Additional Mathematics 6993
June 2007 Assessment Session

Unit Threshold Marks

Unit	Maximum Mark	A	B	C	D	E	U
6993	100	70	60	50	40	30	0

The cumulative percentage of candidates awarded each grade was as follows:

	A	B	C	D	E	U	Total Number of Candidates
6993	**28.8**	**38.6**	**48.1**	**57.5**	**66.8**	**100**	5500

OCR (Oxford Cambridge and RSA Examinations)
1 Hills Road
Cambridge
CB1 2EU

OCR Customer Contact Centre

(General Qualifications)
Telephone: 01223 553998
Facsimile: 01223 552627
Email: general.qualifications@ocr.org.uk

www.ocr.org.uk

OCR (Oxford Cambridge and RSA Examinations)
Head office
Telephone: 01223 552552
Facsimile: 01223 552553