



General Certificate of Secondary Education

Mathematics 3302

Specification B

Module 3 Higher Tier

Mark Scheme

2006 examination – November series

Mark schemes are prepared by the Principal Examiner and considered, together with the relevant questions, by a panel of subject teachers. This mark scheme includes any amendments made at the standardisation meeting attended by all examiners and is the scheme which was used by them in this examination. The standardisation meeting ensures that the mark scheme covers the candidates' responses to questions and that every examiner understands and applies it in the same correct way. As preparation for the standardisation meeting each examiner analyses a number of candidates' scripts: alternative answers not already covered by the mark scheme are discussed at the meeting and legislated for. If, after this meeting, examiners encounter unusual answers which have not been discussed at the meeting they are required to refer these to the Principal Examiner.

It must be stressed that a mark scheme is a working document, in many cases further developed and expanded on the basis of candidates' reactions to a particular paper. Assumptions about future mark schemes on the basis of one year's document should be avoided; whilst the guiding principles of assessment remain constant, details will change, depending on the content of a particular examination paper.

The following abbreviations are used on the mark scheme:

M	Method marks awarded for a correct method.
A	Accuracy marks awarded when following on from a correct method. It is not necessary always to see the method. This can be implied.
B	Marks awarded independent of method.
M dep awarded.	A method mark which is dependent on a previous method mark being awarded.
ft an	Follow through marks. Marks awarded for correct working following a mistake in earlier step.
SC	Special Case. Marks awarded for a common misinterpretation which has some mathematical worth.
oe	Or equivalent.
eeoo	Each error or omission.

Module 3 Higher Tier

Q	Answers	Mark	Comments
1	$660 \div (2 + 3 + 7) (= 55)$	M1	Only allow $2 + 3 + 7 = 11$ or 12 or 13
	their 55×7	M1dep	$\frac{7}{12} \times 660$ is M2
	385	A1	>1 answer given is A0
2(a)	1.25	B1	oe
2(b)(i)	8.55087(...)	B1	
2(b)(ii)	8.6	B1ft	ft from any (i) > 2 significant figures
3(a)	$75 - 66 (= 9)$	M1	$1 - \frac{66}{75} (=0.12)$ or $\frac{66}{75} \times 100 (=88)$
	$\frac{\text{their } 9}{75} \times 100$	M1dep	their 0.12×100 or $100 - \text{their } 88$
	12	A1	
3(b)	Sight of 0.4 oe	M1	$40(\%) = 18.6(0)$ M1
	$18.6(0) \div 0.4$	M1dep	$1(\%) = 18.6(0) \div 40 (= 0.465)$ $100(\%) = (0.465) \times 100$ M1dep
	46.50	A1	Do not allow 46.5 but implies M2
4(a)	3.5×10^{-1}	B1	
4(b)	$6.4 \times 10^{15} \div 8 \times 10^9$	M1	
	800 000	A1	oe eg 0.8×10^6 Note: Correct embedded answers in a multiplication are acceptable eg $8 \times 10^9 \times 800\ 000$ M1 A1 A0 $8 \times 10^9 \times 8 \times 10^5$ M1 A1 A0
	8×10^5	A1	

Q	Answers	Mark	Comments
5(a)	$y = \frac{k}{x^2}$ or $y \propto \frac{1}{x^2}$	M1	oe $50 = \frac{k}{2^2}$ implies M1
	$50 \times 2^2 = k$	M1dep	this seen without first line implies M2
	$200 = k$ $y = \frac{200}{x^2}$	A1	Only need the equation if there was no $y = \frac{k}{x^2}$ earlier
5(b)	$32 = \frac{\text{their } k}{x^2}$	M1	
	$x = \sqrt{(\text{their } k \div 32)}$	M1dep	
	2.5	A1	Allow -2.5 and $\pm 2, 5$
6	When p is even p^3 is even and p^2 is even even – even = even	B1	SC1 eg, $2^3 = 8$ $2^2 = 4$ $8 - 4 = 4$ even – even = even and $3^3 = 27$ $3^2 = 9$ $27 - 9 = 18$ odd – odd = even Must use an even and an odd in their trials. All processing must be correct
	When p is odd p^3 is odd and p^2 is odd odd – odd = even	B1	
Alt 6	$p = 2n$ $(2n)^3 - (2n)^2 = 8n^3 - 4n^2$ $= 2(4n^3 - 2n^2)$ Multiple of 2	B1	$p^3 - p^2 = p^2(p - 1)$ When p is even p^2 is even and $p - 1$ is odd even \times odd = even
	$p = 2n + 1$ $(2n + 1)^3 - (2n + 1)^2$ $= (2n + 1)^2 (2n + 1 - 1)$ $= 2n(2n + 1)^2$ Multiple of 2	B1	$p^3 - p^2 = p^2(p - 1)$ When p is odd p^2 is odd and $p - 1$ is even odd \times even = even

Q	Answers	Mark	Comments
7	$0.45 \times 0.8(0) (= 0.36)$ or $0.45 \times 80 (= 36)$ or $0.8(0) \times 45 (= 36)$	M1	Chooses number of pupils eg, 100 $0.45 \times (100) = (45)$ $0.8(0) \times (45) = (36)$
	$0.55 \times 0.06 (= 0.033)$ or $0.55 \times 6 (= 3.3)$ or $0.06 \times 55 (= 3.3)$	M1	$0.55 \times (100) = (55)$ $0.06 \times (55) = (3.3)$
	$(0.36) + (0.033)$ or $(36) + (3.3)$	M1dep	$(36) + (3.3)$ Dependent on M2 in all methods
	39.3	A1	SC2 Answer 3930
8	$(2\sqrt{50} =) 10\sqrt{2}$	B1	B1 if $\sqrt{50} = 5\sqrt{2}$ and $\sqrt{8} = 2\sqrt{2}$ seen but not multiplied by 2 and 3 respectively
	$(3\sqrt{8} =) 6\sqrt{2}$	B1	
	$(10\sqrt{2}) - (6\sqrt{2})$ simplified correctly to $n\sqrt{2}$ Must have at least one value correct	M1	Allow $5\sqrt{2} - 2\sqrt{2} = 3\sqrt{2}$ from the working above
	32	A1	SC2 Answer 32 with no valid working or answer 31.99.....with or without working
Alt 8	$(2\sqrt{50})^2 = 200$	B1	
	$(3\sqrt{8})^2 = 72$	B1	
	$(200) + (72) - 2 \times 2\sqrt{50} \times 3\sqrt{8}$	M1	
	32	A1	

Q	Answers	Mark	Comments
9	$\frac{8 \times 500}{0.5} (= \frac{4000}{0.5})$ or $\frac{8 \times 503}{0.5} (= \frac{4024}{0.5})$	B2	B1 for any two values correct
	8 000 or 8048 SC1 Either answer with no working	B1	Allow B1 for $\frac{10 \times 500(\text{or } 503)}{0.5}$ or $\frac{8 \times 500(\text{or } 503)}{0.4}$ and B1 for 10000 (or 10060)
10(a)	2 (and) 75 or 3 (and) 50 or 5 (and) 30	M1	Do not allow for a list of factors even in pairs
	$2 (\times) 3 (\times) 5 (\times) 5$	A1	Condone factor of 1
	$2 \times 3 \times 5^2$	A1	Must have \times signs Do not allow factor of 1
10(b)	$3 (\times) 5 (\times) 5$	M1	Selects all common factors from $3^2 \times 5^2$ and their (a)
	75	A1	SC1 Answer 15 or 25
11(a)	South Africa	B1	Accept 1.22×10^6 Accept unambiguous indication on the chart
11(b)	Converts 4.47×10^5 or 11300 to a form where subtraction could be completed without a calculator	M1	eg, 4.47×10^5 to normal form (allow errors with zeros but do not accept 4.4700000 or digits 2235) eg, 11300 to $a \times 10^5$ (allow errors with position of decimal point but a must be $< 11\ 300$)
	447 000 (– 11 300)	A1	
	435 700 or 436 000	A1	oe

Q	Answers	Mark	Comments
12(a)	All points plotted correctly (within half a square)	B1, B1ft	SC1 Misses out 1 point when plotting but joins with acceptable curve
	Smooth curve drawn through all points (within half a square – ft their points but curve must be approximately a U parabola)		
12(b)	Identifies at least one point of intersection with x -axis	M1	
	Two x values that are their graph's intersections with x axis	A1ft	Graphical solutions only Only ft for one solution $-4 < x < -3$ and one solution $0 < x < 1$
12(c)	Subtracts or equates $x^2 + 3x - 2$ and $x^2 - 3$	M1	Subtraction in either order
	Obtains $(y =) 3x + 1$	A1	
	$-1.9 \leq x \leq -1.6$ and $1.6 \leq x \leq 1.9$	A1	Graphical solutions from drawing a straight line Do not allow solutions from a graph of: $y = x^2 - 3$)
13(a)	$5\sqrt{3}$ or $3\sqrt{3}$	M1	
	$8\sqrt{3}$	A1	
13(b)	$\frac{21}{\sqrt{7}} \times \frac{\sqrt{7}}{\sqrt{7}}$	M1	$\frac{21\sqrt{7}}{7}$
	$3\sqrt{7}$	A1	

Q	Answers	Mark	Comments
14(a)	$16 = 2^4$ or $4^{0.5} = 2$	B1	or $16 = 4^2$ 2048 seen implies B1
	their power of 2 from 16 is trebled (2^{12} if correct)	M1	their power of 4 from 16 is trebled (4^6 if correct)
	2^{11} or ($n =$) 11	A1	$4^{5\frac{1}{2}}$ is A0
14(b)(i)	$\frac{3}{2}$	B1	oe
14(b)(ii)	$\frac{1}{1000^{\frac{2}{3}}}$ or $\frac{1}{\left(1000^{\frac{1}{3}}\right)^2}$ or $\left(1000^{\frac{1}{3}}\right)^{-2}$ or 10^{-2} or 100^{-1}	B1	
	$\frac{1}{100}$	B1	Allow 0.01
15	Any one of 125, 245 and 215	M1	
	their min \times (their min – their max)	M1	not dependent
	3750	A1	