

**MARK SCHEME for the October/November 2009 question paper
for the guidance of teachers**

9709/62

9709 MATHEMATICS

Paper 62, maximum raw mark 50

This mark scheme is published as an aid to teachers and candidates, to indicate the requirements of the examination. It shows the basis on which Examiners were instructed to award marks. It does not indicate the details of the discussions that took place at an Examiners' meeting before marking began, which would have considered the acceptability of alternative answers.

Mark schemes must be read in conjunction with the question papers and the report on the examination.

- CIE will not enter into discussions or correspondence in connection with these mark schemes.

CIE is publishing the mark schemes for the October/November 2009 question papers for most IGCSE, GCE Advanced Level and Advanced Subsidiary Level syllabuses and some Ordinary Level syllabuses.

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Mark Scheme Notes

Marks are of the following three types:

M Method mark, awarded for a valid method applied to the problem. Method marks are not lost for numerical errors, algebraic slips or errors in units. However, it is not usually sufficient for a candidate just to indicate an intention of using some method or just to quote a formula; the formula or idea must be applied to the specific problem in hand, e.g. by substituting the relevant quantities into the formula. Correct application of a formula without the formula being quoted obviously earns the M mark and in some cases an M mark can be implied from a correct answer.

A Accuracy mark, awarded for a correct answer or intermediate step correctly obtained. Accuracy marks cannot be given unless the associated method mark is earned (or implied).

B Mark for a correct result or statement independent of method marks.

- When a part of a question has two or more “method” steps, the M marks are generally independent unless the scheme specifically says otherwise; and similarly when there are several B marks allocated. The notation DM or DB (or dep*) is used to indicate that a particular M or B mark is dependent on an earlier M or B (asterisked) mark in the scheme. When two or more steps are run together by the candidate, the earlier marks are implied and full credit is given.
- The symbol \surd implies that the A or B mark indicated is allowed for work correctly following on from previously incorrect results. Otherwise, A or B marks are given for correct work only. A and B marks are not given for fortuitously “correct” answers or results obtained from incorrect working.
- Note: B2 or A2 means that the candidate can earn 2 or 0.
B2/1/0 means that the candidate can earn anything from 0 to 2.

The marks indicated in the scheme may not be subdivided. If there is genuine doubt whether a candidate has earned a mark, allow the candidate the benefit of the doubt. Unless otherwise indicated, marks once gained cannot subsequently be lost, e.g. wrong working following a correct form of answer is ignored.

- Wrong or missing units in an answer should not lead to the loss of a mark unless the scheme specifically indicates otherwise.
- For a numerical answer, allow the A or B mark if a value is obtained which is correct to 3 s.f., or which would be correct to 3 s.f. if rounded (1 d.p. in the case of an angle). As stated above, an A or B mark is not given if a correct numerical answer arises fortuitously from incorrect working. For Mechanics questions, allow A or B marks for correct answers which arise from taking g equal to 9.8 or 9.81 instead of 10.

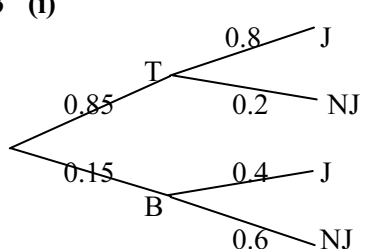
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The following abbreviations may be used in a mark scheme or used on the scripts:

- AEF Any Equivalent Form (of answer is equally acceptable)
- AG Answer Given on the question paper (so extra checking is needed to ensure that the detailed working leading to the result is valid)
- BOD Benefit of Doubt (allowed when the validity of a solution may not be absolutely clear)
- CAO Correct Answer Only (emphasising that no “follow through” from a previous error is allowed)
- CWO Correct Working Only – often written by a ‘fortuitous’ answer
- ISW Ignore Subsequent Working
- MR Misread
- PA Premature Approximation (resulting in basically correct work that is insufficiently accurate)
- SOS See Other Solution (the candidate makes a better attempt at the same question)
- SR Special Ruling (detailing the mark to be given for a specific wrong solution, or a case where some standard marking practice is to be varied in the light of a particular circumstance)

Penalties

- MR –1 A penalty of MR –1 is deducted from A or B marks when the data of a question or part question are genuinely misread and the object and difficulty of the question remain unaltered. In this case all A and B marks then become “follow through $\sqrt{}$ ” marks. MR is not applied when the candidate misreads his own figures – this is regarded as an error in accuracy. An MR –2 penalty may be applied in particular cases if agreed at the coordination meeting.
- PA –1 This is deducted from A or B marks in the case of premature approximation. The PA –1 penalty is usually discussed at the meeting.

1 (i) mean = 51	B1 [1]																					
(ii) $z = \pm 0.674$ $\pm(63 - 51) / \sigma = 0.674$ $\sigma = 17.8$	B1 M1 A1 [3]	Correct z Standardising, no cc, no $\sqrt{\sigma}$, no σ^2 Correct answer																				
2 P(total 7) = P(3,4 or 4,3) = 2/16 P(total 8) = P(4,4) = 1/16 P(7 or more) = 3/16 Expected $200 \times \frac{3}{16} = 37.5$	M1 A1 M1 A1ft [4]	Attempt to find P(7) + P(8) 3/16 seen Multiplying their prob by 200 Correct final answer ft their prob																				
3 (i) 	M1 A1 [2]	Correct shape with T and B first All probs and labels correct																				
(ii) $P(T NJ) = \frac{P(T \text{ and } NJ)}{P(NJ)}$ $P(T \text{ and } NJ) = 0.85 \times 0.2 = 0.17$ $P(NJ) = 0.85 \times 0.2 + 0.15 \times 0.6 = 0.26$ $P(T NJ) = 0.17 / 0.26$ $= 17/26$ oe (= 0.654)	B1 M1 A1 A1 [4]	Correct numerator of a fraction with $0 <$ any denominator < 1 Summing 2 two-factor products Correct denom Correct answer																				
4 (a) (i) 24	B1 [1]	Correct final answer																				
(ii) 3 digit odd 500+ = 4 ways 3 digit odd 600+ = $3 \times 2 = 6$ ways 4 digit odd 1000+ = 4 ways 4 digit odd 3000+ = 4 ways 4 digit odd 5000+ = 4 ways 4 digit odd 6000+ = 6 ways OR 4 digit odd, last digit in 3 ways, 2^{nd} to last in 3 ways, 2^{nd} in 2 ways first in 1 way = 18 Total = 28 ways	M1 M1 M1 A1 [4]	Attempt for 3 digit odd numbers Attempt for 4 digit odd numbers For summing their number of ways with 3-digits and their number of ways with 4-digits Correct total																				
(b) no of ways 4 and 5 not next to each other $= 6! - 5! \times 2! = 720 - 240$ $= 480$ Prob not next = $480/720 = 2/3$	M1 B1 A1 [3]	Finding ways digits not next to each other 240 or 480 seen Correct answer																				
5 (i) $40 = 120 / 3$ so $r = 3$ $P(40) = 3/45 = 1/15$ AG	M1 A1 [2]	$r = 3$ seen or obtained from table Given answer legit obtained																				
(ii) <table border="1" data-bbox="127 1792 654 1971"> <tr> <td>x</td> <td>120</td> <td>60</td> <td>40</td> <td>30</td> </tr> <tr> <td>$P(X=x)$</td> <td>1/45</td> <td>2/45</td> <td>3/45</td> <td>4/45</td> </tr> <tr> <td>24</td> <td>20</td> <td>17.14</td> <td>15</td> <td>13.3</td> </tr> <tr> <td>5/45</td> <td>6/45</td> <td>7/45</td> <td>8/45</td> <td>9/45</td> </tr> </table>	x	120	60	40	30	$P(X=x)$	1/45	2/45	3/45	4/45	24	20	17.14	15	13.3	5/45	6/45	7/45	8/45	9/45	B1 B1 B1 [3]	8 or 9 values for x , correct to nearest integer One correct probability apart from 1/15 Correct table
x	120	60	40	30																		
$P(X=x)$	1/45	2/45	3/45	4/45																		
24	20	17.14	15	13.3																		
5/45	6/45	7/45	8/45	9/45																		

(iii) 40/3 oe (13.3)	B1ft [1]	ft their table
(iv) $P(18 < X < 100) = (2 + 3 + 4 + 5 + 6)/45$ $= 20/45 (4/9) (0.444)$	M1 A1 [2]	Adding 5 probabilities o.e. Correct answer
6 (i) class widths 20, 10, 10, 10, 10, 15 freq density: 2.0, 3.4, 5.6, 5.4, 2.9, 1.4	M1	Attempt at fd or scaled frequency
	A1	Correct heights seen on graph
	B1	Bar lines correctly located at 20.5, 30.5, 40.5, 50.5 and 60.5, no gaps
	B1	Correct widths of bars
	B1	Both axes uniform from at least 0 to 5.6 and 0.5 to 75.5 and labelled (fd or fr per mark, marks)
	[5]	
(ii) mid-points 10.5, 25.5, 35.5, 45.5, 55.5, 68 mean = $\Sigma xf / 234 = 8769.5/234$ $= 37.5$ var = $\Sigma x^2 f / 234 - \text{mean}^2$ sd = 16.9	M1 A1 M1 A1 [4]	Attempt at $\Sigma xf / 234$ using mid-points, NOT class widths, NOT upper class bounds Correct answer Numerical attempt at correct variance formula, NOT class widths Correct answer
7 (i) $P(X > 128) = P\left(z > \frac{128 - 125}{4.2}\right)$ $= P(z > 0.7143)$ $= 1 - 0.7623$ $= 0.238$	M1 M1 A1 [3]	Standardising, no cc, no sq rt Correct area of graph i.e. prob < 0.5 Correct answer, rounding to 0.238
(ii) $P(X > k) = 0.7465 + 0.2377 = 0.9842$ $z = -2.15$ $-2.15 = \frac{k - 125}{4.2}$ $k = 116$	M1 A1 M1 A1 [4]	Valid method to obtain $P(X > k)$, no cc Answer rounding to ± 2.15 seen Solving equation with their z-value, k, 125 and 4.2 or $\sqrt{4.2}$, no cc Correct answer, rounding to 116
(iii) $P(X > 2) = P(3, 4, 5)$ or $1 - P(0, 1, 2)$ $= {}^5C_3(0.2377)^3(0.7623)^2$ $+ {}^5C_4(0.2377)^4(0.7623)^1$ $+ {}^5C_5(0.2377)^5$ $= 0.07804 + 0.01216 + 0.0007588$ $= 0.0910$	M1 M1 A1 A1 [4]	Binomial term of form ${}^5C_x p^x (1 - p)^{5-x}$, $x \neq 0$ Sum of exactly 3 bin probs, any p Correct unsimplified answer Correct answer accept 0.0909 and 0.091 from 0.0910