

Page 4	Mark Scheme: Teachers' version	Syllabus	Paper
	GCE AS/A LEVEL – May/June 2010	9709	62

1	(i) $\bar{x} = 18.9$ (132/7) sd = 12.3	B1 B1 [2]	
	(ii) median	B1 [1]	
	(iii) mode inappropriate because it is 10 and this is the lowest value. mean inappropriate because it is affected by the outlier (of 48).	B1 B1 [2]	Sensible reason allow if seen in (ii) Sensible reason allow if seen in (ii) not 'outliers' in plural
2	(i) $P(x > 10.9) = P\left(z > \frac{10.9 - 11}{0.095}\right)$ $= P(z > -1.0526)$ $= 0.8538$ (0.854)	M1 A1 [2]	Standardising, no cc, no sq rt Rounding to correct answer
	(ii) $P(\text{at least } 2 < 10.9) = 1 - P(0, 1)$ $= 1 - (0.8538)^6 - {}^6C_1(0.1462)(0.8538)^5$ $= 0.215$	M1 A1ft A1 [3]	Bin expression with $\sum$ powers = 6, ${}^6C_x$ , $p + q = 1$ . Reasonably correct unsimplified expression ft their (i) Rounding to correct answer
3	median $A = 2.0 - 2.1$ or $\bar{x}_A = 2.0 - 2.1$ median $B = 3.8 - 3.9$ or $\bar{x}_B = 3.4 - 3.5$	M1 A1 B1	For finding medians or using mid-pts and freqs to find means, or seen on 2 box-plots Correct medians or means for $A$ and $B$ Correct statement allow '...higher median...' etc.
	Country $B$ has heavier babies on average	M1	Finding spreads by IQ range or range or sd or 2 box-plots
	IQ range $A = 2.4 - 1.5 = 0.9$ or sd = 0.5 – 0.7 IQ range $B = 4.5 - 2.2 = 2.3$ or sd = 1.2 – 1.4	A1	Correct IQ range or sd for $A$ and $B$ ( $\pm 0.1$ kg) or correct IQR on box-plots
	Country $B$ has greater spread of weights	A1 [6]	Correct statement
4	(i) $P(X < 2\mu) = P\left(z < \frac{2\mu - \mu}{\sigma}\right)$ $= P(z < \mu/\sigma) = P(z < 5/3)$ $= 0.952$	M1 A1 A1 [3]	Standardising, and attempt to get 1 variable, no cc, no $\sqrt{\quad}$ , no sq $\pm 5/3$ seen oe Rounding to correct answer
	(ii) $P\left(X < \frac{\mu}{3}\right) = P\left(z < \frac{-2\mu}{3\sigma}\right)$  $\frac{-2\mu}{3\sigma} = 1.047$ $\mu = -1.57\sigma$	M1 B1 A1 [3]	standardising attempt resulting in $z \leq -$ some $\mu/\sigma$ allow $\pm \left(\frac{\mu/3 - \mu}{\sigma}\right)$ $\pm 1.047$ seen correct single number, answer must have a minus sign and $\mu = \dots\sigma$
5	(i) (2,12), (3, 8), (4, 6), (6, 4), (8,3), (12,2)	M1	Listing or picking out at least 3 different options from a 12 by 12 (mult) table or seeing 3, 4, 5 or 6/144
	$P(Q) = 6/144$ (1/24) (0.0417)	A1 [2]	Correct answer

Page 5	Mark Scheme: Teachers' version	Syllabus	Paper
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(ii) $P(\text{both} > 8) = 1/3 \times 1/3$ $= 1/9 = P(R) (16/144)$	M1 A1 [2]	Squaring a sensible prob or picking out 12 – 25 options Correct answer								
(iii) since $P(R \text{ and } Q) = 0$ Yes, $R$ and $Q$ are exclusive	B1* B1dep [2]	o.e. in words								
(iv) $P(R \text{ and } Q) = 0 \neq P(R) \times P(Q)$ or $P(R Q) = 0, \neq P(R)$ No, not independent	B1* B1dep [2]	o.e. in words								
6 (i) <table border="1" style="margin-left: 20px;"> <tr> <td><math>x</math></td> <td>0</td> <td>1</td> <td>2</td> </tr> <tr> <td><math>P(X=x)</math></td> <td>1/7</td> <td>4/7</td> <td>2/7</td> </tr> </table>	$x$	0	1	2	$P(X=x)$	1/7	4/7	2/7	B1  B1 B1 [3]	0, 1, 2 only in table or listed with some prob 3, 4... if in table must have blank or 0 for prob One correct probability All correct
$x$	0	1	2							
$P(X=x)$	1/7	4/7	2/7							
(ii) $E(X) = 8/7 (1.14) \text{ AG}$ $\text{Var}(X) = 12/7 - (8/7)^2$ $= 20/49 (0.408)$	B1 M1 A1 [3]	Legitimate correct given answer rounding to 1.14 Correct method with mean <sup>2</sup> subt numerically no dividing by anything Correct final answer								
(iii) $P(G   NA) = \frac{P(G \cap NA)}{P(NA)}$ $= \frac{2/5 \times 1/4}{2/5 \times 1/4 + 3/5 \times 9/10}$ $= \frac{5}{32} (0.156)$	M1 M1 A1 A1 [4]	Attempt at $P(G \cap NA)$ or $P(G \cap A)$ as numerator of a fraction Attempt at $P(NA)$ or $P(A)$ in form of summing two 2-factor products, seen anywhere Correct unsimplified denominator of a fraction Correct answer								
7 (i) 362880 (363000)	B1 [1]									
(ii) PG or GP in $8! \times 2 = 80640$ or 7/9 of (i) $362880 - 80640 = 282240$	M1 B1 A1ft [3]	Considering together and also subtracting from their (i) or using probabilities $8! \times 2$ or 80640 seen oe correct answer ft 40320 only								
(iii) ${}^9P_3$ or ${}^9C_3 \times 3!$ or $9!/6!$ $= 504$	M1 A1 [2]	${}^9P_3$ or ${}^9C_3$ oe seen allow extra multiplication correct final answer								
(iv) ${}^8C_2 \times 3!$ or $504 - {}^8C_3 \times 3!$ or ${}^8P_2 \times 3$ $= 168$	M1 A1 [2]	${}^8C_x$ or ${}^8P_x$ seen allow extra mult, or (iii)/9 or (iii)/3 correct final answer								
(v) PG and $x$ in $7 \times 2 \times 2$ ways = 28 Answer $504 - 28 = 476$	M1 A1 [2]	$x \times 2 \times 2$ seen or their (iii) – 7 or ${}^7C_1$ or ${}^7C_2$ correct answer								