

# **Mark Scheme 4732**

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Note: “(3 sfs)” means “answer which rounds to ... to 3 sfs”. If correct ans seen to  $\geq$  3sfs, ISW for later rounding  
 Penalise 2 sfs only once in paper.

1(i)	Negative, because (grad or coeff of $x$ in 1 <sup>st</sup> equn or $x$ -value or reg coeff or $B$ or $-0.6$ ) is negative	B1	1	Neg because $x$ incr & $y$ decr
(ii)	$x = -1.6x + 7.0 + 21$ $x = 9.8$	M1 A1	2	Sub $y=7.0$ in 2 <sup>nd</sup> eqn. Allow 1 sign error If sub in both must choose 2nd
(iii)	$y = -0.6(-1.6y + 21) + 13$ or similar $\bar{x} = 5, \bar{y} = 10$	M1 A1A1	3	Obtain correct eqn in 1 variable. Allow 1 num'l error Allow without bars
<b>Total</b>			<b>6</b>	
In qus 2 & 3 “prod” means “product of two probabilities”				
2(i)	$^4/7$ or 0.571 (3 sfs)	B1	1	
(ii)	$^5/8 \times ^4/7 + ^3/8 \times ^5/8$ $= ^{265}/_{448}$ or 0.592 (3 sfs)	M1M1 A1	3	M1: one correct prod or add any two prods M1: all correct
(iii)	$^3/8 \times ^5/8 + ^5/8 \times ^3/7$ $= ^{225}/_{448}$ or 0.502 (3 sfs)	M1M1 A1	3	M1: one correct prod or add any two prods M1: all correct
<b>Total</b>			<b>7</b>	
3(i)	$\frac{7!}{3! \times 2!}$ $= 420$	M1M1 A1	3	M1: $7!/(a \text{ factorial})$ ; or $\dots \div (3! \times 2!)$ M1: all correct
(ii)	$\frac{5!}{2!}$ $= 60$	M1 A1	2	M1: $5!$ seen (not part of a C) or $5 \times 4!$ or $120$ seen or $\dots \div 2!$ alone
(iii)	$1 - ^4/7 \times ^3/6$ or $1 - ^4C_2 / ^7C_2$ or $1 - ^4P_2 / ^7P_2$ or $^3/7 \times ^2/6 + ^3/7 \times ^4/6 + ^4/7 \times ^3/6$ oe or $^3C_2 / ^7C_2 + ^3C_1 \times ^4C_1 / ^7C_2$  $= ^5/7$ or 0.714 (3 sfs)	M1M1  A1	3	M1: $1 - \text{prod}$ or $1 - \dots / ^7C_2$ or $1 - ^4C_2 / \dots$ (or Ps) or add 3 prods or add 2 correct prods or $^3C_2 / ^7C_2$ or $^3C_1 \times ^4C_1 / ^7C_2$ or add $\geq 5$ out of 7 correct prods M1: all correct
<b>Total</b>			<b>8</b>	

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4(i)	0.4207 or 0.421 (3 sfs) or $0.8^{25} + 25 \times 0.8^{24} \times 0.2 + \dots + {}^{25}C_4 \times 0.4^{21} \times 0.2^4$ 0.579(3)	B1 B1	2	or $1 - 0.6167$ or $0.3833$ (3 sfs) or $1 -$ (6 correct terms, 0 to 5)
(ii)	${}^{10}C_3 \times (1-0.27)^7 \times 0.27^3$ $= 0.261$ (3 sfs)	M1 A1	2	
(iii)	$0.73^9 = 0.059$ $0.73^{10} = 0.043$  $n = 10$	Allow “=” thro’out $1 - 0.73^n > 0.95$ or $0.73^n < 0.05$ $n \log 0.73 < \log 0.05$ oe	M1 M1  A1	3 or $1 - {}^nC_0 \times 0.27^0 \times 0.73^n > 0.95$ oe allow incorrect sign M1 must be correct ft ( $1 - 0.27$ ) from (ii) for M1M1 10 with incorrect sign in wking: SCB2 10 with just $0.73^9 = 0.059$ : M1M1A1
<b>Total</b>			<b>7</b>	
5(i)	$\frac{1}{3} + \frac{1}{4} + p + q = 1$ oe $0 \times \frac{1}{3} + 1 \times \frac{1}{4} + 2p + 3q = 1\frac{1}{4}$ oe  equalize coeffs, eg mult eqn (i) by 2 or 3 Or make $p$ or $q$ subject of (i) or (ii) $p = \frac{1}{4}, q = \frac{1}{6}$ oe	B1 B1  M1  A1A1	5	allow one error. ft their eqns subst or subtr not nec’y
(ii)	$\sum x^2 p$ (not $\frac{1}{4}$ or $\frac{1}{3}$ etc) $(= 2\frac{3}{4})$ $- (\frac{1}{4})^2$  $= 1.1875$ or $1\frac{3}{16}$ oe sd = $\sqrt{(\text{their } 1.1875)} = 1.09$ (3 sfs)	M1 M1  A1 B1f	4	$\geq 2$ non-zero terms correct. dep +ve result indep if +ve result or $\sqrt{x - (\frac{1}{4})^2} p$ $(\geq 2$ (non-0) terms correct): M2 ft (i) ( $0 \leq p, q < 1$ ) or letters $p, q$ both M1s cao dep 1st M1 & $\sqrt{(+ve \text{ no.})}$ eg $\sqrt{2.75} = 1.66$
<b>Total</b>			<b>9</b>	

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6(i)(a)	<p>Ranks: 2 4 7 5 3 1 6      6 4 1 3 5 7 2                      7 1 6 3 2 5 4      1 7 2 5 6 3 4</p> <p><math>\Sigma d^2</math>                      (= 60)</p> <p><math>r_s = 1 - \frac{6 \times 60}{7 \times 48}</math></p> <p>= <math>-\frac{1}{14}</math> or -0.071 (3 dps)</p>	<p>M1                      A1                      M1                      M1                      A1</p>	<p><math>\geq 5</math> ranks correct in each set                      all correct                      dep ranks attempted even if opp orders,                      allow arith errors                      Correct formula with <math>n = 7</math>, dep 2<sup>nd</sup> M1</p> <p>calc <math>r</math> for ranks:  <math>S_{xx} = S_{yy} = 140 - 28^2/7</math>.    <math>S_{xy} = 110 - 28^2/7</math>                      (= 28)    (= -2)</p> <p>corr subst in one corr <math>S</math> (any version): M1                      corr subst in <math>r = S_{xy} / \sqrt{(S_{xx} S_{yy})}</math> : M1</p> <p>-0.07 without wking: M1A1M2A0</p>
(b)	<p>Little (or no) connection (agreement, rel'nship) between dist and commission                      Allow disagreement</p>	<p>B1ft</p>	<p>1</p> <p>No mks unless <math> r_s  \leq 1</math>                      ft their <math>r_s</math>                      Must refer to context.                      Not “little corr’n between dist and com”                      not “strong disagreement”                      Ignore other comment</p>
(c)	<p>Unchanged. No change in rank</p>	<p>B1B1</p>	<p>2</p>
(ii)(a)	<p>= -1</p>	<p>B1</p>	<p>1</p> <p>indep</p>
(b)	<p>Close to -1 or, eg <math>\approx -0.9</math></p>	<p>B1</p>	<p>cao</p> <p>not referring to “corr’n” rather than <math>r</math>                      allow “neg”, not neg corr’n or neg skew</p>
<b>Total</b>		<b>10</b>	

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7(i)	<p>Midpoints attempted <math>\geq 2</math> classes  <math>\sum xf / 100</math> or <math>\sum xf / \sum f</math> attempted <math>\geq 2</math> terms  <math>x</math> within class, not class width                      Mean = 27.2 (to 3 sfs) (not 27.25)                      art 27.2 from fully correct wking</p> <p><math>\sum x^2 f</math> or <math>\sum (x - \bar{x})^2 f \geq 2</math> terms  <math>\sqrt{(\sum x^2 f / 100 - \bar{x}^2)}</math> or <math>\sqrt{((\sum x - \bar{x})^2 f / 100)}</math> or  <math>\sqrt{\sum f}</math>                      fully corr method, not <math>\sqrt{\text{neg}}</math>                      = 40.5 to 41.1 (3 sfs)</p>	<p>M1 M1  A1  M1 M1 A1</p>	<p><b>6</b></p>	<p><u>Correct (149.5)</u>  2720.5/100  27.2 240702.25 40.82</p>	<p><u>With 150</u>  2725/100  27.25 242050 40.96</p>	<p><u>Tot = 2000</u>  Allow Ms  &amp; poss As</p>
(ii)	<p>Recog LQ in 1<sup>st</sup> class &amp; UQ in 3<sup>rd</sup> class</p> <p><u>Graph:</u> Attempt 25(.25)<sup>th</sup> value  <u>Interp:</u> LQ = 3.0 to 4.3                      Attempt 75(.75)<sup>th</sup> value UQ = 27 to 29</p> <p>Subtract                      IQR = 23 or 24 or 25</p>	<p>B1  M1  M1 A1</p>	<p><b>4</b></p>	<p>both nec'y  dep B1 or M1 integer. dep M2</p>		
(iii)(a)	Increase	B1	<b>1</b>			
(b)	Increase	B1	<b>1</b>			
(c)	No change	B1	<b>1</b>			Ignore "probably" etc
<b>Total</b>			<b>13</b>			
8(i)	<p>Geometric.                      Each attempt (or result or try) indep</p>	<p>B1 B1</p>	<p><b>2</b></p>	<p>In context. Not "events,. trials, outcomes" . Ignore extra</p>		
(ii)(a)	<p><math>(\frac{2}{3})^3 \times \frac{1}{3}</math>                      = <math>\frac{8}{81}</math> or 0.0988 (3 sfs)</p>	<p>M2  A1</p>	<p><b>3</b></p>	<p><math>(\frac{2}{3})^2 \times \frac{1}{3}</math> or <math>(\frac{2}{3})^4 \times \frac{1}{3}</math>:                      allow other numerical "p" (0 &lt; p &lt; 1):M1</p>		
(b)	<p><math>(\frac{2}{3})^3</math>  <math>1 - (\frac{2}{3})^3</math>                       = <math>\frac{19}{27}</math> or 0.704 (3sfs)</p>	<p>M1 M1  A1</p>	<p><b>3</b></p>	<p>not <math>(\frac{2}{3})^3 \times \dots</math>                      or <math>\frac{1}{3} + \frac{2}{3} \times \frac{1}{3} + (\frac{2}{3})^2 \times \frac{1}{3}</math> M2  <math>1 - (\frac{2}{3})^4</math> or <math>1 - ("q")^4</math> M1                      or 3 terms, with 2 correct M1                      or 3 correct terms + 1 extra M1                      or "p" + "qp" + "q<sup>2</sup>p" M1                      or 1 - sum of 3 correct terms M1                      "p" means num value, not <math>\frac{1}{3}</math></p>		
(iii)	3	B1f	<b>1</b>			or $\frac{1}{\sqrt{p}}$
(iv)	<p><math>1 - \frac{19}{27}</math>   <math>(1 - 0.7037)</math> or 0.2963  <math>(\frac{8}{27})^2 \times \frac{19}{27}</math>   <math>0.2963^2 \times 0.7037</math>                      = <math>\frac{1216}{19683}</math>   = 0.0618 (3 sfs)</p>	<p>M1 M1  A1</p>	<p><b>3</b></p>	<p>ft (b) for M1M1 must see method if ft                      Allow figs rounded to 2 sfs for M1M1                      cao. allow art 0.0618 or 0.0617</p>		
<b>Total</b>			<b>12</b>			

Total 72 marks