

Question Number	Scheme	Marks
1.	<p>Total in School = $(15 \times 30) + 150 = 600$</p> <p>random sample of $\frac{30}{600} \times 40$ $= \underline{2}$ from each of the 15 classes</p> <p>random sample of $\frac{150}{600} \times 40$ $= \underline{10}$ from sixth form;</p> <p>Label the boys in each class from 1 – 15 and the girls from 1 – 15. use random numbers to select 1 girl and 1 boy</p> <p>Label the boys in the sixth form from 1 – 75 and the girls from 1 – 75. use random numbers to select <u>5</u> different boys and 5 different girls.</p>	<p>B1</p> <p>(Use of $\frac{40}{their\ 600}$) M1 A1</p> <p>Either</p> <p>A1</p> <p>B1 B1</p> <p>B1</p> <p>(7)</p>

Question Number	Scheme	Marks
2. (a)	$E(R) = 20 + 10 = 30$	B1 (1)
(b)	$\text{Var}(R) = 4 + 0.84, = 4.84$	M1, A1 (2)
(c)	$R \sim N(30, 4.84)$ (Use of normal with their (a),(b)) $P(28.9 < R < 32.64) = P(R < 32.64) - P(R < 28.9)$ $= P\left(Z < \frac{32.64 - 30}{2.2}\right) - P\left(Z < \frac{28.9 - 30}{2.2}\right)$ Stand their σ and μ $= P(Z < 1.2) - P(Z < -0.5)$ $= 0.8849 - (1 - 0.6915)$ Correct area $= 0.8849 - 0.3085 = 0.5764$ (accept AWRT 0.576)	B1ft M1 A1, A1 M1 A1 (6)

<p>3. (a)</p>	$\hat{\mu} = \frac{82 + 98 + 140 + 110 + 90 + 125 + 150 + 130 + 70 + 110}{10}$ $= 110.5$ $\hat{\sigma}^2 = \frac{1}{9}(128153 - 10 \times 110.5^2)$ $= 672.28$	<p>M1 A1 B1 M1 A1 (5)</p>
<p>(b)</p>	<p>95% confidence limits are</p> $110.5 \pm 1.96 \times \frac{25}{\sqrt{10}}$ <p>95% conf. lim. = AWRT(95, 126)</p>	<p>(condone use of 5 instead of 25) (for 1.96) M1 B1 A1√ A1 A1 (5)</p>
<p>(c)</p>	<p>Number of intervals = $\frac{95}{100} \times 15$</p> $= 14.25$	<p>(Allow 14 or 14.3 if method is clear) M1 A1 (2)</p>
		<p>12</p>

4.

H_0 : No association between gender and acceptance
 H_1 : gender and acceptance are associated

	Accept	Not accept	Total
Males	170 (180)	110 (100)	280
Females	280 (270)	140 (150)	420
Totals	450	250	700

Expected Values

B1

M1 A1

O	E	$\frac{(O - E)^2}{E}$
170	180	0.5556
110	100	1.0000
280	270	0.3704
140	150	0.6667

$$\sum \frac{(O - E)^2}{E} = 2.59 \text{ (Yates' 2.34)}$$

(Condone use of Yates')

M1 A1

$$\nu = 1; (5\%) = 3.841$$

B1; B1

$3.841 > 2.59$. There is insufficient evidence to reject H_0

There is no association between a persons gender and their acceptance (of the offer of a flu jab.)

M1
A1√

(9)

9

5. (a)	<p>μ_b = mean mark of boys, μ_g = mean mark of girls.</p> <p>$H_0 : \mu_b = \mu_g$ $H_1 : \mu_b \neq \mu_g$</p> $z = \frac{53 - 50}{\sqrt{\frac{144}{80} + \frac{144}{80}}}$ <p>= 1.58 Critical region $z \geq 1.96$ 1.58 < 1.96 insufficient evidence to reject H_0. No diff. between mean scores of boys and girls.</p>	<p>both</p> <p>B1</p> <p>M1 A1</p> <p>A1 B1 M1 A1</p> <p>(7)</p>
(b)	<p>$H_0 : \mu_b = \mu_g$ $H_1 : \mu_b < \mu_g$</p> $z = \frac{62 - 59}{\sqrt{\frac{36}{80} + \frac{36}{80}}}$ <p>= 3.16</p> <p>Critical region $z \geq 1.6449$ (accept 1.645) 3.16 > 1.6449 sufficient evidence to reject H_0. the mean mark for boys is less than the mean mark of the girls.</p>	<p>B1</p> <p>M1</p> <p>A1</p> <p>B1</p> <p>A1</p> <p>(5)</p>
(c)	<p>Girls have improved more than boys or girls performed better than boys after 1 year</p>	<p>B1</p> <p>(1)</p> <p>13</p>

7. (a)	The variables cannot be assumed to be normally distributed	B1 (1)																																			
(b)	<table border="1" data-bbox="225 232 1075 434"> <thead> <tr> <th></th> <th>20-29</th> <th>30-39</th> <th>40-49</th> <th>50-59</th> <th>60-69</th> <th>70+</th> </tr> </thead> <tbody> <tr> <td>Rank x</td> <td>5</td> <td>6</td> <td>4</td> <td>3</td> <td>1</td> <td>2</td> </tr> <tr> <td>Rank y</td> <td>6</td> <td>5</td> <td>4</td> <td>1</td> <td>3</td> <td>2</td> </tr> <tr> <td>d</td> <td>1</td> <td>1</td> <td>0</td> <td>2</td> <td>2</td> <td>0</td> </tr> <tr> <td>d^2</td> <td>1</td> <td>1</td> <td>0</td> <td>4</td> <td>4</td> <td>0</td> </tr> </tbody> </table> <p data-bbox="225 501 1294 546">$\sum d^2 = 10$ (follow through their rankings)</p> <p data-bbox="225 562 1517 645">$r_s = 1 - \frac{6\sum d^2}{n(n^2 - 1)} = 1 - \frac{60}{210} = 0.714$ ($\frac{5}{7}$ or awrt 0.714)</p>		20-29	30-39	40-49	50-59	60-69	70+	Rank x	5	6	4	3	1	2	Rank y	6	5	4	1	3	2	d	1	1	0	2	2	0	d^2	1	1	0	4	4	0	M1 A1 dM1 (depends on ranking attempt) A1 ft M1 A1 (6)
	20-29	30-39	40-49	50-59	60-69	70+																															
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d	1	1	0	2	2	0																															
d^2	1	1	0	4	4	0																															
(c)	<p data-bbox="225 725 443 792">$H_0: \rho = 0$ $H_1: \rho \neq 0$ (or $\rho > 0$)</p> <p data-bbox="225 824 724 860">$n = 6 \Rightarrow 5\%$ critical value = 0.8857 (or 0.8286)</p> <p data-bbox="225 891 1102 994">0.714 < 0.8857 No evidence to reject H_0; No evidence of correlation between deaths from pneumoconiosis and lung cancer.</p>	B1 B1 B1 ✓ M1 A1 (5)																																			