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

Question Number	Scheme	Marks
2. (a)	E(R) = 20 + 10 = 30	B1 (1)
(b)	Var(R) = 4 + 0.84, = 4.84	M1, A1 (2)
(c)	R ~ N(30, 4.84) (Use of normal with their (a),(b))	B1ft
	P(28.9 < R < 32.64) = P(R < 32.64) - P(R < 28.9)	
	$= \mathrm{P}\left(Z < \frac{32.64 - 30}{2.2}\right) - \mathrm{P}\left(Z < \frac{28.9 - 30}{2.2}\right)$ Stand their σ and μ	M1
		A1, A1
	= P(Z < 1.2) - P(Z < - 0.5)	
		M1
	= 0.8849 - (1 - 0.6915) Correct area	
		A1
	= 0.8849 - 0. 3085 = 0.5764 (accept AWRT 0.576)	(6)
		9

3. (a)	$\hat{\mu} = \dfrac{82+98+140+110+90+125+150+130+70+110}{10}$	M1
	$= 110.5$	A1
	$\hat{\sigma}^2 = \dfrac{1}{9}\left(128153 - 10 \times 110.5^2\right)$ 128153	B1
		M1
	$= 672.28$ (AWRT 672)	A1 (5)
(b)	95% confidence limits are (condone use of 5 instead of 25)	M1
	(for 1.96)	B1
	$110.5 \quad \pm 1.96 \times \dfrac{25}{\sqrt{10}}$	A1√
	95% conf. lim. = AWRT(95, 126)	A1 A1 (5)
(c)	Number of intervals $= \dfrac{95}{100} \times 15$	M1
	$= 14.25$ (Allow 14 or 14.3 if method is clear)	A1 (2)
		12

4.	H_0 : No association between gender and acceptance H_1 : gender and acceptance are associated	B1
	<table><tr><td></td><td>Accept</td><td>Not accept</td><td>Total</td></tr><tr><td>Males</td><td>170 (180)</td><td>110 (100)</td><td>280</td></tr><tr><td>Females</td><td>280 (270)</td><td>140 (150)</td><td>420</td></tr><tr><td>Totals</td><td>450</td><td>250</td><td>700</td></tr></table> Expected Values	M1 A1
	<table><tr><td>O</td><td>E</td><td>$\frac{(O-E)^2}{E}$</td></tr><tr><td>170</td><td>180</td><td>0.5556</td></tr><tr><td>110</td><td>100</td><td>1.0000</td></tr><tr><td>280</td><td>270</td><td>0.3704</td></tr><tr><td>140</td><td>150</td><td>0.6667</td></tr></table>	
	$\sum \frac{(O-E)^2}{E} = 2.59$ (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 Ho There is no association between a persons gender and their acceptance (of the offer of a flu jab.)	M1 A1√ (9)
		9

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

6. (a)	r = 27.07, s = 18.04, t = 0.11 using tables or 0.12 using totals	M1 A1 B1 B1 ft (4)
(b)	Ho : A Poisson model Po(2) is a suitable model. both H_1 : A Poisson model Po(2) is not a suitable model.	B1
	Amalgamate data	M1
	$\sum \frac{(O-E)^2}{E}$ = 3.28 (awrt)	M1 A1
	ν = 6 –1 =5	B1
	$\chi_5^2(5\%)$= 11.070 (follow through their degrees of freedom)	B1ft
	3.25 < 11.070 There is insufficient evidence to reject H_0, <u>Po(2) is a suitable model.</u>	A1ft (7)
(c)	The expected values, and hence $\sum \frac{(O-E)^2}{E}$ would be different, and the degrees of freedom would be 1 less.	B1 B1 (2)
		13

7. (a) The variables cannot be assumed to be normally distributed — B1 (1)

(b)

	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)

$\sum d^2 = 10$ (follow through their rankings) — A1 ft

$r_s = 1 - \frac{6\sum d^2}{n(n^2-1)}$ = 1 - $\frac{60}{210}$ = 0.714 $\left(\frac{5}{7} \text{ or awrt } 0.714\right)$ — M1 A1 (6)

(c) H$_0$: $\rho = 0$ — B1

H$_1$: $\rho \neq 0$ (or $\rho > 0$) — B1

$n = 6 \Rightarrow$ 5% critical value = 0.8857 (or 0.8286) — B1✓

0.714 < 0.8857 — M1

No evidence to reject H$_0$;

No evidence of correlation between deaths from pneumoconiosis and lung cancer. — A1

(5)

12