Question Number	Scheme	Marks
1.	Total in School = (15 × 30) + 150 = 600	B1
	random sample of $\frac{30}{600}\times 40$ (Use of $\frac{40}{their600}$)	M1
	= 2 from each of the 15 classes	A1
	random sample of $\frac{150}{600}\times 40$ Either	
	= 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 5 different boys and 5 different girls.	B1
		(7)

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))	B1ft
	$P(28.9 < R < 32.64) = P(R < 32.64) - P(R < 28.9)$		
	$= P\left(Z < \frac{32.64 - 30}{2.2}\right) - P\left(Z < \frac{28.9 - 30}{2.2}\right)$	Stand their σ and μ	M1
	$= P(Z < 1.2) - P(Z < -0.5)$		A1, A1
	$= 0.8849 - (1 - 0.6915)$	Correct area	M1
	$= 0.8849 - 0.3085 = 0.5764$	(accept AWRT 0.576)	A1 (6)
			9

3. (a)	$\hat{\mu} = \frac{82+98+140+110+90+125+150+130+70+110}{10}$	M1
	$= 110.5$	A1
	$\hat{\sigma}^2 = \frac{1}{9}\left(128153 - 10 \times 110.5^2\right)$ 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
	$110.5 \quad \pm 1.96 \times \frac{25}{\sqrt{10}}$	A1√
	95% conf. lim. = AWRT(95, 126)	A1 A1 (5)
(c)	Number of intervals $= \frac{95}{100} \times 15$	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
	(contingency table below) Expected Values	M1 A1
	(O, E table below)	
	$\sum \frac{(O-E)^2}{E}$ = 2.59 (Yates' 2.34) (Condone use of Yates')	M1 A1
	ν = 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

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

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

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
	$= 1.58$ Critical region $z \geq 1.96$ $1.58 < 1.96$ insufficient evidence to reject Ho. No diff. between mean scores of boys and girls.	A1 B1 M1 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) $3.16 > 1.6449$ sufficient evidence to reject H_0. the mean mark for boys is less than the mean mark of the girls.	B1 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
	$\nu = 6 - 1 = 5$	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_o, Po(2) is a suitable model.	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)	(table below)	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

	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