Question Number	Scheme	Marks
5(a)	$H_0 : \mu_p - \mu_f = 1$ oe	B1
	$H_1 : \mu_p - \mu_f > 1$ oe	B1
	s.e. $= \sqrt{\frac{9}{605} + \frac{4}{45}} = \left[\sqrt{0.10376...}\right] = [0.322\ldots]$	M1
	$z = \pm \frac{7.0 - 5.6 - 1}{"\sqrt{\frac{9}{605} + \frac{4}{45}}"}$	dM1
	$= 1.24175...$ awrt 1.24	A1
	CV 5% one tailed = ±1.6449 (see notes)	B1
	Not significant, do not reject H_0	dM1
	Insufficient evidence that **full-time** staff are more than **one minute** faster than **part-time** staff or manager's **claim** is not supported	A1ft
		(8)
(b)	Assume **both** samples are **normal** or **both** large enough for **CLT** oe	B1
	Assume $s^2 = \sigma^2$ for **both** samples	B1
	Assume individual result**s** are independent	
		(2)
(c)	$\bar{a} = \frac{45 \times 7 + 8}{46} \left[= 7.0217...\right]$	M1
	$\sum a^2 = 44 \times 4 + 45 \times 7^2 + 8^2 \left[= 2445\right]$	M1
	$s^2 = \frac{"2445" - 46 \times "7.0217..."^2}{45}$	M1
	$= 3.93285\ldots$ awrt 3.93	A1
		(4)
	Notes	Total 14
(a)	B1 H_0 correct oe e.g. $H_0 : \mu_f - \mu_p = -1$ Must be in terms of μ Use of $\bar{t}$ is B0. May use other letters to *p* and *f* but must be defined	
	B1 H_1 correct oe e.g. $H_1 : \mu_f - \mu_p < -1$ **SC** B0B1 for $H_0 : \mu_f - \mu_p = 1$ and $H_1 : \mu_f - \mu_p > 1$ Must be in terms of μ Use of $\bar{t}$ is B0 May use other letters to *p* and *f* but must be defined	
	M1 Correct method to find s.e. may be seen within formula to standardise (implied by awrt ±1.24)	
	dM1 dep on previous M being awarded. Correct method to find *z* value (implied by awrt ±1.24)	
	A1 awrt ±1.24	
	B1 awrt ±1.6449 or *p*-value awrt $0.107 > 0.05$ oe	
	dM1 all previous method marks awarded for a correct conclusion ft their *z* value and CV	
	A1ft dependent on all previous method marks but independent of hypotheses. A correct statement in context with the words in bold oe which does not reject H_0. ft their *z* value and CV Note B0B0M1dM1A1B0dM1A1ft is possible	
	Candidates who incorrectly test $H_0 : \mu_f - \mu_p = 1$ and $H_1 : \mu_f - \mu_p > 1$ will score maximum B0B1M1dM0A0B1dM0A0	
(b)	B1 One correct assumption. Accept e.g. (times taken by) employees chosen follow a normal distribution, times taken follow a normal distribution, employees are selected	

	independently. Samples are independent is B0
	B1 2 correct assumptions. Need to see reference to both for each assumption but condone if written as one sentence or statement e.g. both samples are normally distributed and $s^2 = \sigma^2$
(c)	M1 correct method to find $\bar{a}$ may be implied by awrt 7.02 or may be seen within a calculation e.g. $\left(s^2 =\right) \dfrac{2445 - \dfrac{\left(45\times 7+8\right)^2}{46}}{45}$
	M1 correct method to find $\sum a^2$ may see e.g. $2381+8^2$ which may be embedded within their calculation to find the sample variance. Sight of 2445 implies this mark
	M1 correct method to find s^2 ft their $\bar{a}$ (which cannot be 315) and $\sum a^2$ (which cannot be 2381)
	A1 awrt 3.93