Question	Scheme	Marks	AOs
4(a)	$\bar{X} = \frac{1680}{60} = 28$ (minutes)	B1	1.1b
	$S_{xx} = 47654.4 - \frac{1680^2}{60} (= 614.4)$	M1	1.1b
	St dev $= \sqrt{\frac{S_{xx}}{60}} = 3.2$ minutes	A1	1.1b
		(3)	
(b)	$H_0 : \mu = 27.5 \quad H_1 : \mu > 27.5$ Using $\bar{X} \sim N\left(27.5, \frac{3^2}{60}\right)$	B1 M1	2.5 3.3
	Test value $z = \frac{28 - 27.5}{3/\sqrt{60}} = 1.2909...$	A1ft	1.1b
	Critical value $z = 1.64485...$ 1.64 or better	B1	1.1b
	Not in critical region so insufficient evidence to support Lucy's belief oe	A1cso	3.5a
		(5)	
(c)(i)	Assumption of constant probability of success, $p = 0.2$ is unreasonable oe	B1	3.4
	As 5 fastest and 5 beginners have differing chances	B1	2.4
(ii)		**(2)**	
	e.g. Model 5 fastest and 5 beginners as 2 independent binomial distributions each with $n = 5$ but different values of p	B1	3.5c
		(1)	
			(11 marks)

Notes:

(a) B1 28 cao
M1 use of formula for S_{xx} oe alternative method
A1 3.2 minutes or 3 minutes 12 seconds

(b) B1 both hypotheses correct, must be in terms of μ
M1 correct model for $\bar{X}$ using their sample mean and standard deviation
A1 ft their sample mean and standard deviation
B1 correct critical value for z or correct p value (0.09835…) awrt 0.098
A1 cso correct conclusion in context

(c)(i) 1st B1 correct comment on 0.2
2nd B1 valid reason in context
(ii) B1 idea of separate distributions to model each group