Exam Questions – Set 5 - Answers

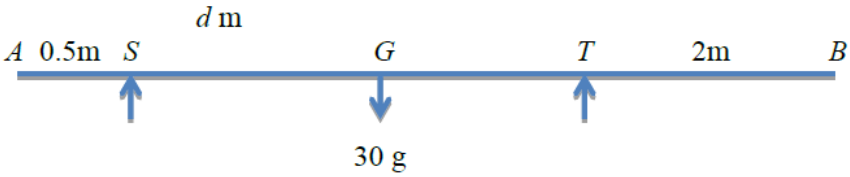
1.

i		T(before) = 0.2g = 1.96 Fr = 0.4x0.2$g$cos30 (=0.67896..) 0.2a = 0.2g – T Either correct 0.2a = T - 0.2$g$sin30 - 0.4x0.2$g$cos30 Both correct 2T = 0.2g + 0.2$g$sin30 + 0.4x0.2$g$cos30 T = 1.81 N	**B1** **B1** **M1** **A1** **M1** **A1** **[6]**
ii		THIS CANNOT BE SOLVED USING a(i) 0.2a = +/- (0.2$g$sin30 + 0.4x0.2$g$cos30) a = +/-(8.2948..) v^2 = 2x8.29(48..)x0.8 *OR* 0 = u^2 - 2x8.29(48..)x0.8 v = 3.64 m s^{-1} or u = 3.64 m s^{-1}	**M1*** **A1** **A1** **D*M1** **A1** **[5]**
iii		R^2 = (0.2$g$cos30)^2 + (0.4x0.2$g$cos30)^2 R=1.83 N	**M1** **A1** **A1** **[3]**

2.

(a)	$\frac{(\mathbf{i}-4\mathbf{j})-(4\mathbf{i}-8\mathbf{j})}{0.5};(\pm 6\mathbf{i} \pm 8\mathbf{j})$ $\sqrt{(\pm 6)^2+(\pm 8)^2}=10$	M1 A1 M1 A1 (4)
(b)	$\mathbf{r}=(4\mathbf{i}-8\mathbf{j})+t(-6\mathbf{i}+8\mathbf{j})$ $=(4\mathbf{i}-8\mathbf{j})-6t\mathbf{i}+8t\mathbf{j}$ $=(4-6t)\mathbf{i}+(8t-8)\mathbf{j}$ *	M1 A1 (2)
(c)	At 10 am, $\mathbf{r}=-2\mathbf{i}$ At 10.30 am, $\mathbf{r}=-5\mathbf{i}+4\mathbf{j}$ $\mathbf{l}=k\mathbf{i},\ k<-2$ $k=-5-4=-9$ $\mathbf{l}=-9\mathbf{i}$	M1 A1 A1 DM1 A1 (5) **11**

3.



$M(S)$: $Mg \leftrightarrow 0.5 = 30g(d-0.5)$ — M1 A1

$M(T)$: $Mg \leftrightarrow 2 = 30g(4-d)$ — M1 A1

dividing: $4 = \dfrac{(4-d)}{(d-0.5)}$ => (i) $d = 1.2$ — **DM1** A1

=> (ii) $M = 42$ — A1

4.

At maximum height	**M1**	For considering maximum height
$v^2 - u^2 = 2as \Rightarrow 0^2 - 8^2 = 2\times(-9.8)\times h$	**M1**	Use of suitable *suvat* equation(s) eg finding and using t for maximum height (0.816 s). Allow for use of calculus.
$h = 3.265...$	**A1**	CAO but allow 3.26 as well as 3.27
$(3.265... < 4)$ so the stone misses the pigeon	**A1**	Dependent on previous mark
Alternative		
Substitute $y = 4$ in $y = 8t - 4.9t^2$	**M1**	
Attempt to solve $4.9t^2 - 8t + 4 = 0$	**M1**	
Discriminant (= 64 - 4 × 4.9 × 4 = - 14.4) < 0	**A1**	
No value of t so the stone does not reach height 4 m	**A1**	
Time to house is $\dfrac{22.5}{15} = 1.5$ s	**B1**	
Height at house $= 8\times1.5 - \frac{1}{2}\times9.8\times1.5^2 = 0.975$ m	**B1**	Allow answers from essentially correct working that round to 0.96, 0.97 or 0.98, eg 0.96375 from $g = 9.81$
$0.8 < 0.975 < 2.0$ so it hits the window.	**B1**	A 2-sided inequality must be given, either in figures or in words. Condone $0.8 < 0.975 < 1.2$ Dependent on previous mark

5.

(a)	[$T \sim N(240, 40^2)$…require $P(T > 300)$]		
	$P\left(Z > \frac{300-240}{40}\right)$	M1	
	$= 1 - P(Z < 1.5)$ or $1 - 0.9332$	M1	
	= awrt **0.0668** or 6.68%	A1	
			(3)
(b)	$[P(T < n) = 0.20 \Rightarrow]$ $\frac{n-240}{40} = -0.8416$	M1 B1	
	n = awrt **206** minutes	A1	
			(3)
(c)	$[P(W < \mu - 30 \mid W < \mu) =]$ $\frac{P(W < \mu - 30)}{P(W < \mu)}$	M1	
	$= \frac{1-0.82}{0.50}$	A1	
	$= \mathbf{0.36}$	A1cao	
			(3)

6.

(a)

$H_0 : p = 0.45$ $H_1 : p < 0.45$ (or $p \neq 0.45$)		
$X \sim B(20, 0.45)$	M1	
$P(X \leq 5) = 0.0553$ CR $X \leq 4$	A1	
Accept H_0. Not significant. 5 does not lie in the Critical region.	M1d	
There is no evidence that the proportion who voted for Mrs George is not 45% or there is evidence to support Mrs George's claim	A1cso	
		(4)

(b)

B(8, 0.45): P(0) = 0.0084	M1	
B(7, 0.45): P(0) = 0.0152	A1	
Hence smallest value of n is **8**	B1	
		(3)
Alternative		
$(0.55)^n < 0.01$	M1	
$n\log 0.55 < \log 0.01$		
$n > 7.7\ldots$	A1	
Hence smallest value of n is **8**	B1cso	

7.

(a)	$[P(B \cap R') =]$ **0**	B1	(1)
(b)	$P(B) = 0.27+0.33 = 0.6$, $P(D) = 0.27 + 0.15 + t$, $P(B \cap D)=0.27$	M1	
	$[P(B) \times P(D) = P(B \cap D)$ gives$]$ $0.6 \times (0.42 + t) = 0.27$	M1	
	$0.42 + t = \frac{0.27}{0.6}$ or $0.6t = 0.018$	A1	
	$t =$ **0.03**	A1	(4)
(c)	$[u =]$ $1-(0.6+0.15+t)$	M1	
	$u =$ **0.22**	A1ft	(2)
(d)(i)	$\left[\frac{P(D \cap R \cap B)}{P(R \cap B)} =\right] = \frac{0.27}{0.27+0.33}$ or $P(D \mid R \cap B) = P(D \mid B) = P(D)$	M1	
	$=$ **0.45**	A1	
(ii)	$\left[\frac{P(D \cap [R \cap B'])}{P(R \cap B')} =\right] = \frac{0.15}{0.15+u}$	M1	
	$= \frac{15}{37}$	A1	(4)
(e)	$40 \times$"0.45" and $37 \times$"$\frac{15}{37}$"	M1	
	$=$ **33**	A1	(2)