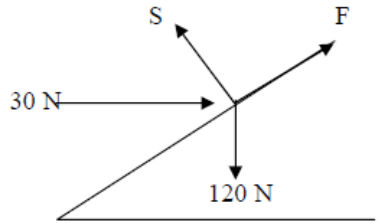
Mixed Exam Questions – Set 11 - Answers

1.

(a)



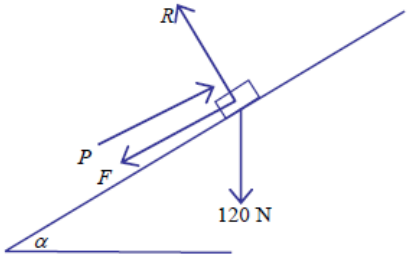
Resolving perpendicular to the plane:

$S = 120\cos\alpha + 30\sin\alpha$ — M1 A1 A1

$= 114$ * — A1

(4)

(b)



Resolving perpendicular to the plane:

$R = 120\cos\alpha$ — M1 A1

$= 96$ — A1

$F_{max} = \frac{1}{2}R$ — M1

Resolving parallel to the plane:

In equilibrium: $P_{max} = F_{max} + 120\sin\alpha$ — M1 A(2,1,0)

$= 48 + 72 = 120$ — A1

(8)

(c)	$30+F=120\sin\alpha$ **OR** $30-F=120\sin\alpha$	M1 A1
	So $F=42\text{N}$ acting up the plane.	A1 **(3)**

2.

(a)		$k(1+2+3+4+5) \quad (=1)$	**M1**	**3.3**	Allow $15k \ (=1)$	
		$k=\frac{1}{15}$	**A1**	**1.1**	May be implied	

		P($X=3$) = $3\times\frac{1}{15}$ or $\frac{3}{15}$ (= 0.2 **AG**)	**A1** **[3]**	**2.1**	Must see $3\times\frac{1}{15}$ or $\frac{3}{15}$ and answer 0.2		
(b)		1 2 3 4 5 $\frac{1}{15}$ $\frac{2}{15}$ $\frac{3}{15}$ $\frac{4}{15}$ $\frac{5}{15}$ oe 0.07, 0.13, 0.2, 0.27, 0.33	**M1** **A1** **[2]**	**1.2** **1.1**	M1 for ≥ 3 probs correct, ft their k cao. Allow decimals **(2 dp)** SC: Table with all five probs = 0.2: M1	Allow $X=0$ or $X=6$ or $X=6+$ if prob shown as 0	
(c)		Both parts. Allow mixture of methods					
(c)	**(i)**	$\frac{3}{15}\times\frac{4}{15}+\frac{2}{15}\times\frac{5}{15}$ oe $\times 2$ $=\frac{44}{225}$ or 0.196 (3 sf)	**M1** **M1** **A1** **[3]**	**3.4** **3.1a** **1.1**	Correct products added, ft their table 2×(Sum of two products of probs) cao	**Special cases** **2-way table** Count 4 pairs M1 But if (b) correct: M0 ÷ 25 M1 = 0.16 A0	**All probs = 0.2** $0.2^2+0.2^2$ M1 But if (b) correct: M0 $2\times(0.2^2+0.2^2)$ Allow without 2× M1 = 0.16 A0
(c)	**(ii)**	P(one value is 2 & $T=7$) = $2\times\frac{2}{15}\times\frac{5}{15}$ $=\frac{4}{45}$ $\frac{P(\text{one value is 2 \& } T=7)}{P(T=7)}$ ($\frac{\frac{4}{45}}{\frac{44}{225}}$ or = $\frac{0.0889}{0.196}$) $=\frac{5}{11}$ or 0.455 (3 sf)	**M1** **A1f** **M1** **A1** **[4]**	**3.4** **1.1** **2.1** **1.1**	Allow without "2×", ft their table ft their table (except if all probs = 0.2) Allow any probability / Their (c)(i) or their $P(T=7)$ cao NB not 0.454 Eg: If (i) $\frac{22}{225}$, $\frac{2}{45}\div\frac{22}{225}=\frac{5}{11}$ M1A0M1A0	Count 2 pairs M1 A0 ÷ 4 M1 = 0.5 A0	2×0.2^2 M1 = 0.08 A0 $\frac{0.08}{0.16}$ M1 = 0.5 A0

3.

H_0: $\mu = 13.3$, H_1: $\mu < 13.3$ $z = \frac{12.48 - 13.3}{\sqrt{12.25/50}} = -1.6566$ $[p = 0.0488]$ $[12.25/50 = 0.245]$ < -1.645 $[p < 0.05]$	B2 M1 A1 B1
CV $13.3 - 1.645\sqrt{\frac{12.25}{50}} = 12.4857\ldots$ $12.48 < \text{CV}$	M1 B1 A1
Reject H_0. Significant evidence that animals in zoos have shorter expected lifetime	M1 A1ft 7

4.

(a)	$[\mathrm{P}(T>20)=]\ \mathrm{P}\left(Z>\frac{20-18}{5}\right)$	M1
	$\mathrm{P}(Z>0.4)=1-0.6554$	M1
	$=$ **0.3446** or awrt **0.345**	A1
		(3)
(b)	Require $\mathrm{P}(T>20 \mid T>15)$ or $\frac{\mathrm{P}(T>20)}{\mathrm{P}(T>15)}$	M1
	$\frac{\text{"(a)"}}{\mathrm{P}(Z>\frac{15-18}{5})} = \frac{\text{"(a)"}}{\mathrm{P}(Z>-0.6)}$, $= \frac{\text{"0.3446"}}{0.7257}$ or $\frac{\text{"0.345"}}{0.726}$	M1, A1ft
	$=0.47485\ldots=$ awrt **0.475**	A1
		(4)
(c)	$\mathrm{P}(T>d \mid T>15)=0.5$ or $\mathrm{P}(T<d \mid T>15)=0.5$	M1
	$\mathrm{P}(T>d)$ or $\mathrm{P}(15<T<d)=0.5\times$"0.7257" =[0.36285]	A1ft
	$\mathrm{P}(T<d)=$"0.63715"	M1
	So $\frac{d-18}{5}=0.35$ (calculator gives 0.35085…)	A1
	$d=19.754\ldots$ = awrt **19.8**	A1cso
	(Accept 19 mins 45(secs) or 19:45 but 19.45 is A0)	(5)