FS1Ch1 XMQs and MS

(Total: 74 marks)

1. FS1_2019 Q6 . 12 marks - FS1ch1 Discrete random variables

2. FS1_2019 Q7 . 12 marks - FS1ch3 Geometric and negative binomial distributions

3. FS1_2020 Q4 . 8 marks - FS1ch1 Discrete random variables

4. FS1_2021 Q4 . 10 marks - FS1ch1 Discrete random variables

5. FS1_2022 Q2 . 9 marks - FS1ch1 Discrete random variables

6. FS1_2023 Q1 . 9 marks - FS1ch1 Discrete random variables

7. FS1_2024 Q1 . 6 marks - FS1ch1 Discrete random variables

8. FS1_Specimen Q2 . 8 marks - FS1ch1 Discrete random variables

6. The discrete random variable X has probability generating function

$$G_X(t) = k \ln\left(\frac{2}{2-t}\right)$$

where k is a constant.

(a) Find the exact value of k

(1)

(b) Find the exact value of $\text{Var}(X)$

(7)

(c) Find $P(X = 3)$

(4)

Qu	Scheme	Marks	AO
6 (a)	$G(1) = 1 \Rightarrow k\ln 2 = 1$ so $k = \underline{\underline{\dfrac{1}{\ln 2}}}$	B1	2.1
		(1)	
(b)	$\left\{G(t) = \dfrac{1}{\ln 2}\left[\ln 2 - \ln(2-t)\right]\right\} \Rightarrow G'(t) = \dfrac{1}{\ln 2}\left[\dfrac{1}{2-t}\right]$ or $\dfrac{1}{\ln 2}(2-t)^{-1}$	M1 A1	2.1 1.1b
	[E(X) =] $G'(1) = \dfrac{1}{\ln 2}$	A1	1.1b
	$G''(t) = \dfrac{1}{\ln 2} \times \left[\dfrac{1}{(2-t)^2}\right]$	M1 A1	2.1 1.1b
	$\text{Var}(X) = G''(1) + G'(1) - \left[G'(1)\right]^2 = \dfrac{1}{\ln 2} + \dfrac{1}{\ln 2} - \left(\dfrac{1}{\ln 2}\right)^2$	M1	2.1
	$= \underline{\dfrac{1}{\ln 2}\left(2 - \dfrac{1}{\ln 2}\right)}$	A1	1.1b
		(7)	
(c)	P(X = 3) = coefficient of t^3 by Maclaurin need $G'''(0)$	M1	3.1a
	$G'''(t) = \dfrac{1}{\ln 2}\dfrac{2}{(2-t)^3}$	A1ft	1.1b
	$\text{P}(X = 3) = \dfrac{G'''(0)}{3!}$	M1	3.2a
	$= \frac{\frac{1}{4\ln 2}}{6} = \dfrac{1}{24\ln 2} = 0.0601122\ldots$ awrt **<u>0.0601</u>**	A1	1.1b
		(4)	
		(12 marks)	

	Notes
(a)	B1 for finding k (must be exact)
(b)	1st M1 for an attempt to differentiate $G(t)$ e.g. $A(2-t)^{-1}$ (o.e.) 1st A1 for a correct first derivative (condone k or use of $\frac{1}{\ln 2}$ = awrt 1.44) 2nd A1 for correct E(X) or $G'(1)$ (allow awrt 1.44 calc: 1.442695…but not k) seen anywhere 2nd M1 for attempting second derivative (ft their $G'(t)$) 3rd A1 for a correct 2nd derivative (condone k or use of $\frac{1}{\ln 2}$ = awrt 1.44) 3rd M1 for a correct method for Var(X) (some substitution into the correct formula) 4th A1 for $\dfrac{1}{\ln 2}\left(2 - \dfrac{1}{\ln 2}\right)$ o.e. but must simplify i.e. collect like terms [Mark final answer – penalise incorrect log work etc] NB 0.8040211.. is A0 unless exact answer seen
(c)	1st M1 for a suitable strategy to solve the problem (finding link with Maclaurin) Need mention of coefficient of t^3 **and** [$G'''(t)$ or $G'''(0)$](condone $G'''(1)$) 1st A1ft for 3rd derivative , ft their 2nd derivative in (b) (provided $G''(t)$ not const) Correct $G'''(t)$ or $G'''(0)$ scores 1st M1 1st A1ft 2nd M1 for translating Maclaurin to probability (a correct expression) 2nd A1 for $\frac{1}{24\ln 2}$ or awrt 0.0601

7. A spinner can land on red or blue. When the spinner is spun, there is a probability of $\frac{1}{3}$ that it lands on blue. The spinner is spun repeatedly.

The random variable B represents the number of the spin when the spinner first lands on blue.

(a) Find (i) $P(B = 4)$

(ii) $P(B \leqslant 5)$

(4)

(b) Find $E(B^2)$

(3)

Steve invites Tamara to play a game with this spinner.

Tamara must choose a colour, either red or blue.

Steve will spin the spinner repeatedly until the spinner first lands on the colour Tamara has chosen. The random variable X represents the number of the spin when this occurs.

If Tamara chooses red, her score is e^X

If Tamara chooses blue, her score is X^2

(c) State, giving your reasons and showing any calculations you have made, which colour you would recommend that Tamara chooses.

(5)

ALT	**Log series** 1st M1 attempt to write G(t) in suitable form as far as: $k[\ln 2 - \ln(2[1-\frac{t}{2}])]$
	1st A1 reaching $-k\ln(1-\frac{t}{2})$ 2nd M1 use of $-\ln(1-x)$ series (some correct substitution) NB $G(t) = \frac{1}{\ln 2}\left(\frac{t}{2}+\frac{t^2}{8}+\frac{t^3}{24}+...\right)$

Qu	Scheme	Marks	AO
7(a)(i)	[B~Geo($\frac{1}{3}$)] $P(B=4) = \left(\frac{2}{3}\right)^3 \times \frac{1}{3}$	M1	3.3
	$= \frac{8}{81}$	A1	1.1b
(ii)	$P(B \text{ ,, } 5) = 1 - P(B>5)$ or $1-\left(\frac{2}{3}\right)^5$	M1	2.1
	$= \frac{211}{243}$	A1	1.1b
		(4)	
(b)	$E(B^2) = \text{Var}(B) + [E(B)]^2$	M1	2.1
	From formula booklet: $E(B) = \frac{1}{\frac{1}{3}} = 3$ and $\text{Var}(B) = \frac{1-\frac{1}{3}}{\left(\frac{1}{3}\right)^2} = 6$	B1	1.1b
	So $E(B^2) = 6 + 9 =$ **15**	A1	1.1b
		(3)	
(c)	[Let R = no. of the spin when it first lands on red] $X = R$~Geo($\frac{2}{3}$)	M1	3.3
	Require $E(e^X) = \sum_{x=1}^{\infty} e^x \left(\frac{1}{3}\right)^{x-1}\frac{2}{3}$	M1	3.1a
	$= \frac{2e}{3}\sum_{x=1}^{\infty}\left(\frac{e}{3}\right)^{x-1}$	M1	2.1
	$= \frac{2e}{3}\times\frac{1}{1-\frac{e}{3}}$ or $\frac{2e}{3-e}$	A1	1.1b
	$E(e^X) = 19.297\ldots$ {> 15 = $E(B^2)$} so Tamara should **choose red** since it has the greater expected score	A1	2.2a
		(5)	
		(12 marks)	

	Notes
(a)(i)	M1 for selecting the correct model i.e. Geo(p) (May be implied by a correct expression) A1 for $\frac{8}{81}$ (= 0.098765… accept awrt 0.0988)
(ii)	M1 for a suitable strategy to use the geometric model to find a correct expression A1 for $\frac{211}{243}$ (= 0.868312…accept awrt 0.868)
(b)	M1 for a suitable strategy to find $E(B^2)$ [allow $G''(1)+G'(1)$] B1 for use of the correct formulae to find $E(B) = 3$ and $\text{Var}(B) = 6$ or $G''(1) = 12$ A1 for 15
SC	**Formula for $E(B^2)$** Allow M1B1A0 for $E(B^2) = \frac{2-p}{p^2}$ (o.e.)

Qu7	Notes
(c)	1st M1 for choosing a suitable geometric model (sight of Geo($\frac{2}{3}$) or at least 3 correct probabilities) 2nd M1 for realising the need for appropriate expected value and using E(g(X)) [Need sum and f(x)] NB simply finding $e^{E(X)} = e^{1.5}$ = awrt 4.48 is M0 and probably no more marks. 3rd M1 for a suitable strategy to turn the expression into a sum that can be found 1st A1 for correct use of sum to infinity of geometric series 2nd A1 for interpreting the outcome of the calculations in terms of a solution to the problem must choose red and see the awrt 19.3 (and allow ft of their E(B^2) < 19)

4. The discrete random variable X has the following probability distribution.

x	–5	–2	3	4
$P(X = x)$	$\frac{1}{12}$	$\frac{1}{6}$	$\frac{1}{4}$	$\frac{1}{2}$

(a) Find Var(X)

(3)

The discrete random variable Y is defined in terms of the discrete random variable X

When X is negative, $Y = X^2$

When X is positive, $Y = 3X - 2$

(b) Find $P(Y < 9)$

(3)

(c) Find $E(XY)$

(2)

Question	Scheme	Marks	AOs
4(a)	$[\mathrm{E}(X) =](-5)\times\frac{1}{12}+(-2)\times\frac{1}{6}+(3)\times\frac{1}{4}+(4)\times\frac{1}{2}[=2]$	M1	1.1b
	$[\mathrm{E}(X^2) =](-5)^2\times\frac{1}{12}+(-2)^2\times\frac{1}{6}+(3)^2\times\frac{1}{4}+(4)^2\times\frac{1}{2}[=13]$ (oe)	M1	1.1b
	$\mathrm{Var}(X) = \mathrm{E}(X^2) - [\mathrm{E}(X)]^2 = 13 - 2^2$ $= \underline{\mathbf{9}}$	A1	1.1b
		(3)	
(b)	$\begin{array}{\|c\|c\|c\|c\|c\|}\hline x & (-5) & -2 & 3 & (4) \\ \hline y & (25) & 4 & 7 & (10) \\ \hline p & (\frac{1}{12}) & \frac{1}{6} & \frac{1}{4} & (\frac{1}{2}) \\ \hline \end{array}$	M1	3.1a
	$\mathrm{P}(Y < 9) = \mathrm{P}(X = -2) + \mathrm{P}(X = 3)$ $[= \frac{1}{6}+\frac{1}{4}]$	M1	1.1b
	$= \underline{\frac{5}{12}}$	A1	1.1b
		(3)	
(c)	$\mathrm{E}(XY) = (-5)(25)\frac{1}{12}+(-2)(4)\times\frac{1}{6}+(3)(7)\times\frac{1}{4}+(4)(10)\times\frac{1}{2}$	M1	3.1a
	$= \underline{13.5}$	A1	1.1b
		(2)	
			(8 marks)

Notes	
(a)	**M1:** Attempt at $\mathrm{E}(X)$ with at least 3 correct products seen **M1:** Attempt at $\mathrm{E}(X^2)$ with at least 3 correct products seen **A1:** 9 cao Alternative **M1:** Attempt at $\mathrm{E}(X)$ with at least 3 correct products seen **M1:** Attempt at expression for $\mathrm{E}((X-\mu)^2) = (-5-2)^2\times\frac{1}{12}+(-2-2)^2\times\frac{1}{6}+(3-2)^2\times\frac{1}{4}+(4-2)^2\times\frac{1}{2}$ with at least 3 correct terms **A1:** 9 cao
(b)	**M1:** Finding distribution of Y **M1:** $\mathrm{P}(X = -2) + \mathrm{P}(X = 3)$ or $\mathrm{P}(Y = 4) + \mathrm{P}(Y = 7)$ **A1:** $\frac{5}{12}$ (condone awrt 0.417)
(c)	**M1:** Attempt at E(XY) with at least 2 correct terms **A1:** 13.5

4. Members of a photographic group may enter a maximum of 5 photographs into a members only competition.
Past experience has shown that the number of photographs, N, entered by a member follows the probability distribution shown below.

n	0	1	2	3	4	5
$P(N = n)$	a	0.2	0.05	0.25	b	c

Given that $E(4N + 2) = 14.8$ and $P(N = 5 \mid N > 2) = \frac{1}{2}$

(a) show that $Var(N) = 2.76$

(6)

The group decided to charge a 50p entry fee for the first photograph entered and then 20p for each extra photograph entered into the competition up to a maximum of £1 per person. Thus a member who enters 3 photographs pays 90p and a member who enters 4 or 5 photographs just pays £1

Assuming that the probability distribution for the number of photographs entered by a member is unchanged,

(b) calculate the expected entry fee per member.

(3)

Bai suggests that, as the mean and variance are close, a Poisson distribution could be used to model the number of photographs entered by a member next year.

(c) State a limitation of the Poisson distribution in this case.

(1)

Question	Scheme	Marks	AOs
4(a)	$4\text{E}(N) + 2 = 14.8$ or $\text{E}(N) = 3.2$	M1	3.1a
	$0.2 + 0.1 + 0.75 + 4b + 5c = 3.2$	M1	1.1b
	$\frac{c}{0.25 + b + c} = 0.5$ or $0.25 = c - b$	M1	3.1a
	$b = 0.1$ and $c = 0.35$		
	$\text{E}(N^2) = 1\times0.2 + 4\times0.05 + 9\times0.25 + 16\times\text{"0.1"} + 25\times\text{"0.35"}\left[=13\right]$	M1	1.1b
	$\text{Var}(N) = \text{"13"} - \text{"3.2"}^2$	dM1	1.1b
	= 2.76 *	A1*	2.1
		(6)	
(b)	fee: 0, 50, 70, 90, 100, 100 / P($N = n$): a, 0.2, 0.05, 0.25, b, c	M1	3.3
	$50\times0.2 + 70\times0.05 + 90\times0.25 + 100\times\text{"0.1"} + 100\times\text{"0.35"}$	M1	1.1b
	= 81p	A1	1.1b
		(3)	
(c)	Poisson distribution will assign substantial probability to $N > 5$	B1	3.5b
		(1)	
			(10 marks)

Notes

(a)	**M1:**	For using the given information to find E(N)
		ALT $a + b + c = 0.5$ oe
	M1:	For use of $\sum n\text{P}(N = n) = \text{"3.2"}$ At least 3 terms correct
		ALT $\sum(4n + 2)\text{P}(N = n) = 14.8 \Rightarrow 2a + 1.2 + 0.5 + 3.5 + 18b + 22c = 14.8$ At least 3 terms correct
	M1:	Forming an equation in b and c using conditional probability
	M1:	For using $\sum n^2\text{P}(N = n)$ Allow with the letters b and c
	dM1:	Dependent on previous method mark. Correct method to find Var(N)
	A1*:	All previous marks must be awarded and 2.76 stated
(b)	**M1:**	Setting up a new model with the correct fees. At least 3 terms correct. Allow 0.5, 0.7, 0.9, 1
	M1:	Correct method for calculating E(fee) Allow with the letters b and c
	A1:	81[p] No units needed. Allow 0.81 if fees are in pounds
(c)	**B1:**	A correct limitation.

2. The discrete random variable X has probability distribution

x	–5	–1	0	5	b
$P(X = x)$	0.3	0.25	0.1	0.15	0.2

where b is a constant and $b > 5$

(a) Find $E(X)$ in terms of b

(1)

Given that $Var(X) = 34.26$

(b) find the value of b

(4)

(c) Find $P(X^2 < 2 - 3X)$

(4)

2(a)	$\left[\mathrm{E}(X)=\right]0.2b-1$	B1 **(1)**	1.1b
(b)	$\mathrm{E}(X^2)=25\times0.3+1\times0.25\left[+0\times0.1\right]+25\times0.15+0.2b^2\left[=11.5+0.2b^2\right]$	M1	1.1b
	$"11.5+0.2b^2"-("0.2b-1")^2\left[=34.26\right]$	M1	3.1a
	$0.16b^2+0.4b-23.76\left[=0\right]$ or $\frac{4}{25}b^2+\frac{2}{5}b-\frac{594}{25}\left[=0\right]$	M1	1.1b
	b = **11** [since $b > 5$]	A1 **(4)**	2.2a
(c)	<table><tr><td>X</td><td>–5</td><td>–1</td><td>0</td><td>5</td><td>“11”</td></tr><tr><td>X^2</td><td>25</td><td>1</td><td>0</td><td>25</td><td>"121"</td></tr><tr><td>$2-3X$</td><td>17</td><td>5</td><td>2</td><td>– 13</td><td>"– 31"</td></tr><tr><td>X^2-2</td><td>23</td><td>–1</td><td>–2</td><td>23</td><td>"119"</td></tr><tr><td>$-3X$</td><td>15</td><td>3</td><td>0</td><td>15</td><td>"–33"</td></tr><tr><td>X^2+3X</td><td>10</td><td>–2</td><td>0</td><td>40</td><td>“154”</td></tr><tr><td>X^2+3X-2</td><td>8</td><td>–4</td><td>–2</td><td>38</td><td>“152”</td></tr></table>	M1 A1ft	2.1 1.1b
	$\mathrm{P}\left(X^2<2-3X\right)=\mathrm{P}(X=-1)+\mathrm{P}(X=0)$	M1	2.2a
	= **0.35**	A1 **(4)**	1.1b
			Total 9

(a)	**B1**	Correct expression for $\mathrm{E}(X)$
(b)	**1st M1**	Correct attempt at $\mathrm{E}(X^2)$ using $\sum x^2\mathrm{P}(X=x)$ at least 3 correct non-zero products Allow $(-5)^2$ etc
	2nd M1	Realising that Var(X) = $\mathrm{E}(X^2)-[\mathrm{E}(X)]^2$ needs to be **used**
	3rd M1	Reducing their equation to a 3 term quadratic. At least 2 terms correct. Allow e.g. $0.16b^2 + 0.4b = 23.76$ Condone missing “=0”
	A1	For 11 only (from the correct equation) so –13.5 must be eliminated Correct answer with no incorrect working seen scores 4/4
(c)	**1st M1**	At least 4 values correct for (X^2 **and** $2-3X$) or for (X^2-2 **and** $-3X$) or X^2+3X or X^2+3X-2 (o.e.) Allow for solving equation with one sign error
	1st A1ft	All correct or correct ft with their b but must have $b > 5$ (accurate to 1 sf) Allow solving equation to get awrt –3.6 **and** awrt 0.56 or $\frac{-3\pm\sqrt{17}}{2}$ (ft their $b > 5$) If there are omissions **but no errors** in the lists of values then if 2nd M1 and 2nd A1 are scored then the 1st M1 and 1st A1 can be given by implication.
	2nd M1	For identifying the correct values of X required i.e. $X = -1$ and $X = 0$
	2nd A1	0.35 **NB** It is possible to score M0A0M1A1 here if their table of values is incorrect Correct answer with no incorrect working seen scores 4/4 (Allow correct use of their $b > 5$)

1. The discrete random variable X has probability distribution

x	– 2	– 1	0	1	3
$P(X = x)$	0.25	a	b	a	0.30

where a and b are probabilities.

(a) Find $E(X)$

(2)

Given that $Var(X) = 3.9$

(b) find the value of a and the value of b

(4)

The independent random variables X_1 and X_2 each have the same distribution as X

(c) Find $P(X_1 + X_2 > 3)$

(3)

Qu 1	Scheme	Marks	AO
(a)	[E(X) =] $-2\times0.25 + -1\times a + 0\times b + 1\times a + 3\times0.3$	M1	1.1b
	$= \underline{\mathbf{0.4}}$	A1	1.1b
		(2)	
(b)	$\mathrm{E}(X^2) = (-2)^2\times0.25 + (-1)^2\times a + 0 + 1^2\times a + 3^2\times0.3$ $(= 2a + 3.7)$	M1	2.1
	[Var(X) =] $3.9 = 2a + 3.7 - "0.4^2"$	dM1	1.1b
	$a = \underline{\mathbf{0.18}}$	A1	1.1b
	[Use of sum of probs = 1 implies $2a + b = 0.45$] $b = \underline{\mathbf{0.09}}$	A1ft	1.1b
		(4)	
(c)	$X_1 + X_2 > 3$ when $X_1 = 3, X_2 = 1$ $X_1 = 1, X_2 = 3$ $X_1 = 3, X_2 = 3$	M1	3.4
	[P $(X_1 + X_2 > 3)$=]		
	$"0.18"\times0.3 + 0.3\times"0.18" + 0.3\times0.3$ or $2\times0.3\times(0.3 + "0.18") - 0.3^2$	M1	1.1b
	$= \underline{\mathbf{0.198}}$	A1	1.1b
		(3)	
		(9 marks)	

	Notes
(a)	M1 for a correct attempt (at least 3 correct non-zero terms or products and addition) division by k $(k \neq 1)$ is M0 A1 for 0.4 o.e. (correct answer only scores 2 out of 2)
(b)	1st M1 for a correct attempt at E(X^2) (at least 3 correct non-zero products and addition) Missing brackets around –2 and –1 is M0 unless recovered 2nd dM1 (dep on 1st M1) for use of 3.9 = their $\mathrm{E}(X^2) - [\mathrm{E}(X)]^2$ ft their E(X) = 0.4 1st A1 for a = 0.18 o.e. 2nd A1 (dep on 1st M1 only) for b = 0.09 o.e. or their $b = 0.45 - 2\times"a"$ (provided both a and b are probabilities)
(c)	1st M1 for identifying at least 2 cases e.g. $X_1 = 3, X_2 \geqslant 1$ counts as 2 cases (ignore extras including any incorrect pairs identified) implied by at least two correct products of probs. or correct ft products of probs. 2nd M1 for a correct numerical expression for the probability ft their "0.18" A1 for 0.198 o.e.

1. The discrete random variable X has the following probability distribution

x	– 1	0	1	3	5
$P(X = x)$	0.2	0.1	0.2	0.25	0.25

(a) Find Var(X)

(3)

(b) Find Var(X^2)

(3)

Qu	Scheme	Mark	AO
1 (a)	$E(X) = [-1\times 0.2 + 0 + 1\times 0.2] + 3\times 0.25 + 5\times 0.25$ [= 2]	M1	1.1b
	$E(X^2) = (-1)^2\times 0.2 + 0 + 1\times 0.2 + 3^2\times 0.25 + 5^2\times 0.25$ [= 8.9]	M1	1.1b
	[Var(X) = 8.9 – 4 =] **4.9**	A1	1.1b
		(3)	
(b)	$E(X^4) = (-1)^4\times 0.2 + 0 + 1\times 0.2 + 3^4\times 0.25 + 5^4\times 0.25$ [= 176.9]	M1	2.1
	Var(X^2) = " 176.9" – " 8.9" ^{2}	M1	1.1b
	= 97.69 awrt **97.7**	A1	1.1b
		(3)	
		(6 marks)	

	Notes
(a)	1st M1 for an attempt at E(X), at least the final 2 products seen or an answer of 2 2nd M1 for attempting a correct expression for E(X^2), at least 3 non-zero products seen A1 for 4.9 or exact equivalent
(b)	1st M1 for attempting a correct expression, at least 3 non-zero products seen (implied by 176.9) 2nd M1 for a correct method, ft their 176.9 and their 8.9 but must be intending E(X^4) and E(X^2) A1 for 97.69 or awrt 97.7

2. The discrete random variable Y has probability distribution given by

y	a	2	7
$P(Y = y)$	$\frac{1}{2}$	$\frac{3}{10}$	$\frac{1}{5}$

where a is a constant.

Given that $\text{Var}(Y) = 28$ and $E(Y) < 0$

(a) find the value of a.

(6)

(b) Find $E\left(\frac{1}{3 - Y}\right)$

(2)

Question	Scheme	Marks	AOs
2(a)	$\text{Var}(Y) = \text{E}(Y^2) - [\text{E}(Y)]^2$	M1	3.1a
	$\text{E}(Y) = \frac{1}{2}a + 2 \times \frac{3}{10} + 7 \times \frac{1}{5} [= \frac{1}{2}a + 2]$	B1	1.1b
	$\text{E}(Y^2) = \frac{1}{2}a^2 + 4 \times \frac{3}{10} + 49 \times \frac{1}{5} [= \frac{1}{2}a^2 + 11]$	B1	2.1
	$28 = \frac{1}{2}a^2 + 11 - \left(\frac{1}{2}a + 2\right)^2$	M1	1.1b
	$\frac{1}{4}a^2 - 2a - 21 = 0 \quad \rightarrow a = \ldots$	M1	1.1b
	$a = -6$ since $\text{E}(Y) < 0$	A1	2.2a
		(6)	
(b)	$\left(\frac{1}{3-(\text{'}-6\text{'})}\right) \times \frac{1}{2} + \left(\frac{1}{3-2}\right) \times \frac{3}{10} + \left(\frac{1}{3-7}\right) \times \frac{1}{5}$	M1	2.1
	$= \frac{11}{36}$	A1ft	1.1b
		(2)	
			(8 marks)
	Notes		
(a)	1st M1 Realising that $\text{Var}(Y) = \text{E}(Y^2) - [E(Y)]^2$ is required 1st B1 Correct expression for $\text{E}(Y)$ 2nd B1 Correct expression for $\text{E}(Y^2)$ 2nd M1 Equating their expression for $\text{Var}(Y) = 28$ 3rd M1 Solving the equation to find at least 1 value of a A1 -6 only		
(b)	M1 Correct expression for $\text{E}\left(\frac{1}{3-Y}\right)$ or for finding all values of $\frac{1}{3-Y}$ A1ft $\frac{11}{36}$ or awrt 0.306 ft on $a < -4$		