1. A discrete random variable is such that each of its values is assumed to be equally likely.

(a) Write down the name of the distribution that could be used to model this random variable.
(1)

(b) Give an example of such a distribution.
(1)

(c) Comment on the assumption that each value is equally likely.
(2)

(d) Suggest how you might refine the model in part (a).
(2)
(Total 6 marks)

2. The discrete random variable X has probability function

$$P(X = x) = \begin{cases} 0.2, & x = -3, -2, \\ \alpha, & x = -1, 0 \\ 0.1, & x = 1, 2. \end{cases}$$

Find

(a) α,
(2)

(b) $P(-1 \leq X < 2)$,
(1)

(c) F(0.6),
(1)

(d) the value of a such that $E(aX + 3) = 1.2$,
(4)

(e) Var(X),

(4)

(f) Var($3X - 2$).

(2)
(Total 14 marks)

1.	(a)	(Discrete) Uniform	B1	1
	(b)	e.g. Tossing a fair dice / coin	B1g	1
	(c)	Useful in theory – allows problems to be modelled not necessarily true in practice	B1g B1h	 2
	(d)	Carry out an experiment to establish probabilities	B1g B1h	 2

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2.

x	-3	-2	-1	0	1	2
$P(X = x)$	0.2	0.2	α	α	0.1	0.1

(a)	$2\alpha + 0.6 = 1 \Rightarrow \alpha = 0.2$ *linear function of* α *=1, 0.2*	M1A1	2
(b)	$P(-1 \leq X < 2) = P(-1) + P(0) + P(1) = 0.5$	B1	1
(c)	$F(0.6) = 0.8$	B1	1
(d)	$E(X) = (-3 \times 0.2) + \ldots\ldots + (2 \times 0.1) = -0.9$ $\Sigma xP(X = x), -0.9$	M1A1	
	$aE(X) + 3 = 1.2 \Rightarrow a(-0.9) = -1.8$ $aE(X) + 3$	M1	
	$a = 2$	A1	4
(e)	$E(X^2) = (-3^2 \times 0.2) + \ldots.. + (2^2 \times 0.1) = 3.3$ $\Sigma x^2P(X = x), 3.3$	M1A1	
	$\text{Var}(X) = 3.3 - (-0.9)^2 = 2.49$ $\Sigma x^2P(X = x) - (E(X))^2, 2.49$	M1A1	4

(f)	$\text{Var}(3X - 2) = 9\text{Var}(X)$	M1	
	$= 9 \times 2.49 = 22.41$	A1	2

[14]

1. This question was very demanding for candidates with many failing to understand what was required for part (c) and part (d), but usually picking up both marks for (a) and (b). Some candidates did not understand what they were being asked to discuss in this question and it was clear that some centres had not taught probability from a practical point of view, while others were very familiar with using experiments to find empirical probabilities. The responses to part (c) and part (d) were generally vague and regularly incoherent.

2. This proved a good source of marks to many candidates. In part (a), the piecewise definition of the probability function seemed unfamiliar to some candidates, who proceeded to obtain the value of a as 0.7. Most candidates were able to complete this calculation satisfactorily. Part (b) was frequently answered correctly; however, some candidates were unable to adequately deal with the inequality signs. The notation F(x) seemed unfamiliar to the majority of candidates. Parts (d) and (e) were well answered; lost marks generally came from using an incorrect value of a from part (a) and the belief that Var(X) = $E(X^2)$. Part (f) was also well answered, although the usual errors of 3Var(X) and, less frequently, 3Var(X)- 2 still appeared in some scripts.