A-Level Starter Activity

Jethwa Maths

Topic: Discrete Random Variables

Chapter Reference: Statistics 1, Chapter 6

6 minutes

1. The discrete random variable X has the probability function,

$$P(X = x) = \begin{cases} kx & x = 2, 4, 6 \\ k(x-2) & x = 8 \\ 0 & otherwise \end{cases}$$

where k is a constant.

a. Show that $k = \frac{1}{18}$ **(2)**

b. Find the exact value of $F(5)$ **(2)**

2. The discrete random variable X can take only the values 1, 2 and 3. For these values the cumulative distribution function is define by,

$$F(x) = \frac{x^3 + k}{40} \qquad x = 1, 2, 3$$

a. Show that $k = 13$ **(3)**

b. Find the probability distribution of X **(4)**

Solutions

1a.

$P(X = x) = 1$ $2k + 4k + 6k + 6k = 1$ $18k = 1$	**M1**
$k = \frac{1}{18}$	**M1**

1b.

$F(5) = P(X \leq 5)$ $= (X = 2) + P(X = 4)$ $= 6k$	**M1**
$= 6(\frac{1}{18})$ $= \frac{1}{3}$	**M1**

2a.

As $F(3) = 1$	**M1**
$\frac{3^3+k}{40} = 1$ $27 + k = 40$	**M1**
$k = 13$	**M1**

2b.

$F(1) = \mathrm{P}(X = 1)$ $= \frac{1+13}{40} = \frac{14}{40} = \frac{7}{20}$	**M1**
$F(2) = P(X = 2) = F(2) - P(X = 1)$ $= \frac{2^3+13}{40} - \frac{14}{40}$	**M1**
$= \frac{7}{40}$	**M1**
<table><tr><th>x</th><th>1</th><th>2</th><th>3</th></tr><tr><td>**P(X = x)**</td><td>$\frac{7}{20}$</td><td>$\frac{7}{40}$</td><td>$\frac{19}{40}$</td></tr></table>	**M1**

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