

20 March 2019

7.3 Homework: Binomial distribution and review

1a. A discrete random variable X has the following probability distribution.

x	0	1	2	3
$P(X=x)$	$\frac{3}{10}$	$\frac{4}{10}$	$\frac{2}{10}$	p

Find p .

[3 marks]

1b. Find $E(X)$.

[3 marks]

2a. The random variable X has the following probability distribution, with $P(X > 1) = 0.5$.

x	0	1	2	3
$P(X=x)$	p	q	r	0.2

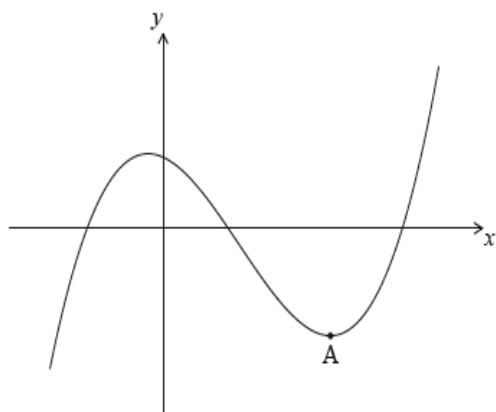
Find the value of r .

[2 marks]

2b. Given that $E(X) = 1.4$, find the value of p and of q .

[6 marks]

3a. The following diagram shows the graph of a function f . There is a local minimum point at A , where $x > 0$.



The derivative of f is given by $f'(x) = 3x^2 - 8x - 3$.

Find the x -coordinate of A .

[5 marks]

3b. The y -intercept of the graph is at $(0, 6)$. Find an expression for $f(x)$.

The graph of a function g is obtained by reflecting the graph of f in the y -axis, followed by a translation of $\begin{pmatrix} m \\ n \end{pmatrix}$.

[6 marks]

4a. Let L_x be a family of lines with equation given by $r = \begin{pmatrix} x \\ \frac{2}{x} \end{pmatrix} + t \begin{pmatrix} x^2 \\ -2 \end{pmatrix}$, where $x > 0$.

Write down the equation of L_1 .

[2 marks]

4b. A line L_a crosses the y -axis at a point P .

Show that P has coordinates $\left(0, \frac{4}{a}\right)$.

[6 marks]

4c. The line L_a crosses the x -axis at $Q(2a, 0)$. Let $d = PQ^2$.

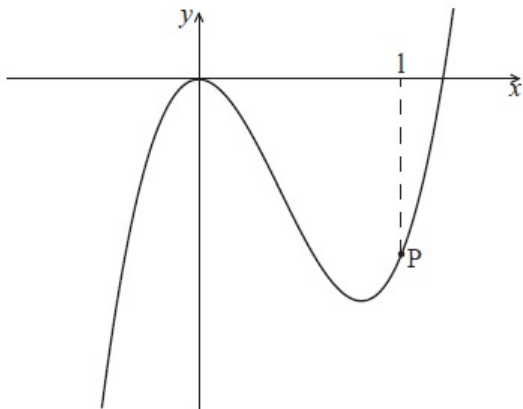
Show that $d = 4a^2 + \frac{16}{a^2}$.

[2 marks]

4d. There is a minimum value for d . Find the value of a that gives this minimum value.

[7 marks]

5a. Part of the graph of $f(x) = ax^3 - 6x^2$ is shown below.



The point P lies on the graph of f . At P , $x = 1$.

Find $f'(x)$.

[2 marks]

5b. The graph of f has a gradient of 3 at the point P . Find the value of a .

[4 marks]

6a. In this question, you are given that $\cos \frac{\pi}{3} = \frac{1}{2}$, and $\sin \frac{\pi}{3} = \frac{\sqrt{3}}{2}$.

The displacement of an object from a fixed point, O is given by $s(t) = t - \sin 2t$ for $0 \leq t \leq \pi$.

Find $s'(t)$. [3 marks]

6b. In this interval, there are only two values of t for which the object is not moving. One value is $t = \frac{\pi}{6}$.

Find the other value. [4 marks]

6c. Show that $s'(t) > 0$ between these two values of t . [3 marks]

6d. Find the distance travelled between these two values of t . [5 marks]

7a. Consider the following sequence of figures.

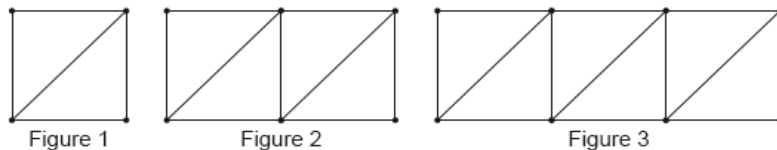


Figure 1 contains 5 line segments.

Given that Figure n contains 801 line segments, show that $n = 200$. [3 marks]

7b. Find the total number of line segments in the first 200 figures. [3 marks]

8a. Let $x = \ln 3$ and $y = \ln 5$. Write the following expressions in terms of x and y .

$\ln\left(\frac{5}{3}\right)$. [2 marks]

8b. $\ln 45$. [4 marks]

9. Three consecutive terms of a geometric sequence are $x - 3$, 6 and $x + 2$.

Find the possible values of x . [6 marks]