**Question 1**

[Maximum mark: 6]

The following box-and-whisker plot shows the number of tweets sent by people in a coffee shop on a particular day.

(a) Find the value of the interquartile range. [2]

(b) One person sent $k$ tweets, where $k > 7$. Given that $k$ is an outlier, find the least value of $k$. [4]

**Question 2**

[Maximum mark: 6]

Consider the following sequence of figures.

Figure 1 contains 6 line segments.

(a) Given that Figure $n$ contains 101 line segments, show that $n = 20$. [3]

(b) Find the total number of line segments in the first 20 figures. [3]

**Question 3**

[Maximum mark: 7]

Let $f(x) = ax^2 - 24x + c$. A horizontal line, $L$, intersects the graph of $f$ at $x = 1$ and $x = 7$.

(a) (i) The equation of the axis of symmetry is $x = h$. Find $h$. [4]

(ii) Hence, show that $a = 3$. [3]

(b) The equation of $L$ is $y = 6$. Find the value of $c$. [3]
Question 4

Maximum mark: 7

The following diagram shows an archery target which is divided into three regions A, B and C.

A contest consists of an archer shooting one arrow at the target. The probability of hitting each region is given in the following table.

<table>
<thead>
<tr>
<th>Region</th>
<th>A</th>
<th>B</th>
<th>C</th>
</tr>
</thead>
<tbody>
<tr>
<td>Probability</td>
<td>1/24</td>
<td>4/24</td>
<td>7/24</td>
</tr>
</tbody>
</table>

(a) Find the probability that the arrow does not hit the target. [3]

The archer scores points as shown in the following table.

<table>
<thead>
<tr>
<th>Region</th>
<th>A</th>
<th>B</th>
<th>C</th>
<th>Outside Target</th>
</tr>
</thead>
<tbody>
<tr>
<td>Points</td>
<td>10</td>
<td>6</td>
<td>k</td>
<td>−4</td>
</tr>
</tbody>
</table>

(b) Given that the contest is fair, find the value of k. [4]

Question 5

Maximum mark: 6

Five equilateral triangles, each with side length 4 cm, are arranged to form a truss bridge model. This is shown in the following diagram.

The vectors \( \mathbf{a}, \mathbf{b} \) and \( \mathbf{c} \) are shown on the diagram.

Find \( \mathbf{a} \cdot (\mathbf{a} + \mathbf{b} + 2\mathbf{c}) \).

Question 6

Maximum mark: 7

The expression \( 8 \sin x \cos x \) can be written in the form \( p \sin qx \).

(a) Find the value of \( p \) and the value of \( q \). [3]

(b) Hence or otherwise, solve the equation \( 8 \sin x \cos x = 2\sqrt{3} \), for \( \frac{\pi}{4} \leq x \leq \frac{\pi}{2} \). [4]
Question 7
May 2019 Maths SL Prediction Exams → Paper 1

[Maximum mark: 7] 

Let \( f(x) = 6x - \ln x \), for \( x > 0 \).

(a) Find \( f'(x) \).  [2]
(b) Find \( f''(x) \).  [1]
(c) Solve \( f'(x) = f''(x) \).  [4]

Question 8
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[Maximum mark: 13] 

A function \( f(x) \) has derivative \( f'(x) = 6x^2 - 24x \). The graph of \( f \) has an \( x \)-intercept at \( x = 1 \).

(a) Find \( f(x) \).  [6]
(b) The graph of \( f \) has a point of inflexion at \( x = k \). Find \( k \).  [4]
(c) Find the values of \( x \) for which the graph of \( f \) is concave-up.  [3]

Question 9
May 2019 Maths SL Prediction Exams → Paper 1

[Maximum mark: 15] 

The first two terms of an infinite geometric sequence are \( u_1 = 20 \) and \( u_2 = 16 \sin^2 \theta \), where \( 0 < \theta < 2\pi \), and \( \theta \neq \pi \).

(a) (i) Find an expression for \( r \) in terms of \( \theta \).  [5]

(ii) Find the possible values of \( r \).  [5]

(b) Show that the sum of the infinite sequence is \( \frac{100}{3 + 2 \cos 2\theta} \).  [4]

(c) Find the values of \( \theta \) which give the greatest value of the sum.  [6]
A closed cylindrical can with radius $r$ cm and height $h$ cm has a volume of $24\pi$ cm$^3$.

(a) Express $h$ in terms of $r$. 

The material for the base and top of the can costs 15 cents per cm$^2$ and the material for the curved side costs 10 cents per cm$^2$. The total cost of the material, in cents, is $C$.

(b) Show that $C = 30\pi r^2 + \frac{480\pi}{r}$. 

(c) Given that there is a minimum value for $C$, find this minimum value in terms of $\pi$. 

[Maximum mark: 15]