Section A (52 marks)

Answer all the questions in this section.

[moderate]

1. Solve the simultaneous equations

\[ \begin{align*}
2x - 5y &= 19 \\
3x + 7y &= -15
\end{align*} \]

[3]

[moderate]

2. (a) A designer watch appreciates in value by 8% each year.
   The cost of a new designer watch is $2875. Calculate the value of the watch after 2 years.

(b) A part-time staff at a bookstore is paid a normal rate of $x per hour and an overtime rate of $y per hour.
   On a weekday, he works for 12 hours at normal rate and 4 hours at overtime rate. He was paid $138.

   Show that \( 6x + 2y = 69 \)

[1]

[simple]

3. The variable \( y \) is inversely proportional to the square of the variable \( 3x \). It is also given that when \( y = 2, x = 5 \).

   Find

   (a) the equation relating \( y \) and \( x \),

   [2]

   (b) the values of \( x \) when \( y = 2 \).

   [2]
4. Based on an annual report in 2017, the income generated by a manufacturing Company X was estimated to be $14.65 million. (1 million = $1 \times 10^6)

(a) Express 14.65 million in standard form. [1]

(b) Company X generated $14.65 million from the sale of 230 000 hard disks which were manufactured and sold in 2017. Calculate the average cost of 1 hard disk. [1]

5. Erfan is $x$ years old.
   His uncle is 23 years older than Erfan.
   7 years later, his uncle will be twice as old as Erfan.

(a) Write down an expression in $x$ for Erfan’s age 7 years later. [1]

(b) Write down an expression in $x$ for his uncle’s age 7 years later. [1]

(c) Form an equation $x$, and solve it to find Erfan’s age [3]

6. On the number line given below, the fractions are placed at equal distances apart.

```
|   |   |   |   |   |   |

\frac{1}{3} \quad a \quad b \quad c \quad d \quad \frac{2}{3}
```

Find the fractions $a$, $b$, $c$ and $d$. [2]
7. The graph below shows the speed-time graph of a car during a period of $t$ seconds.

(a) Calculate the speed of the motorcycle at 20s,

(b) After 30s, its deceleration doubled. Find the value of $t$

(c) Calculate the average speed of the motorcycle for the whole journey.
8. The diagram below shows two solid metal figures, a cylinder and a prism. The cylinder has a diameter of 5 cm and height of 8 cm. The prism has a cross-sectional area in the shape of a triangle with height 7 cm and base 6 cm. The prism has a length of \( L \) cm.

(a) Calculate the volume of the cylinder. (Take \( \pi = 3.14 \))

(b) Calculate the cross-sectional area of the prism.

(c) Given that the volume of the prism is 315 cm\(^3\), find the length, \( L \) of the prism.

(d) If the metal can be melted and remoulded into another shape, what is the minimum number of cylinder(s) required to form a prism?
9. The weights of a shipment of boxes are represented in the following stem-and-leaf diagram.

<table>
<thead>
<tr>
<th>Stem</th>
<th>Leaf</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>0 4 7 7 7</td>
</tr>
<tr>
<td>2</td>
<td>3 4 5 6</td>
</tr>
<tr>
<td>3</td>
<td>1 2 2 w 5 5 6 7</td>
</tr>
<tr>
<td>4</td>
<td>0 1 5 6 7</td>
</tr>
<tr>
<td>5</td>
<td>1 4</td>
</tr>
</tbody>
</table>

Key: 1 | 0 means 10 kg

(a) Find

(i) the value of \( w \) if the median weight of the boxes is 32.5 kg. \[1\]

(ii) the modal weight \[1\]

(iii) the percentage of boxes less than the modal weight \[1\]

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10. (a) Factorise completely \( 12a^2 - 6ab + 4ac - 2bc \). \[2\]

(b) Simplify \( \frac{6x + 1}{2} - \frac{4x}{3} \). \[2\]
11. The table below shows an extract of the tax rates from the Tax Authority last year.

<table>
<thead>
<tr>
<th>Chargeable Income</th>
<th>Rate (%)</th>
<th>Gross Tax Payable ($)</th>
</tr>
</thead>
<tbody>
<tr>
<td>First $20 000</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Next $10 000</td>
<td>2</td>
<td>200</td>
</tr>
<tr>
<td>First $30 000</td>
<td>-</td>
<td>200</td>
</tr>
<tr>
<td>Next $10 000</td>
<td>3.50</td>
<td>350</td>
</tr>
<tr>
<td>First $40 000</td>
<td>-</td>
<td>550</td>
</tr>
<tr>
<td>Next $40 000</td>
<td>7</td>
<td>2800</td>
</tr>
<tr>
<td>First $80 000</td>
<td>-</td>
<td>3350</td>
</tr>
<tr>
<td>Next $40 000</td>
<td>11.5</td>
<td>4600</td>
</tr>
<tr>
<td>First $120 000</td>
<td>-</td>
<td>7950</td>
</tr>
<tr>
<td>Next $40 000</td>
<td>15</td>
<td>6000</td>
</tr>
<tr>
<td>First $160 000</td>
<td>-</td>
<td>13950</td>
</tr>
<tr>
<td>Next $40 000</td>
<td>17</td>
<td>6800</td>
</tr>
</tbody>
</table>

(a) Calculate the tax payable for a chargeable income of $115 000 according to the tax rates given in the table above.

(b) An additional information on reliefs is given below.

**Relief:**
- NS man: $200
- 4-room dwelling: $300
- Wife: $2000
- Children: $1500 each
- Parent: $4500 per parent.

Mr Amir who is an NS man, has four children and he has to support his wife and mother. He lives in a 4 - room dwelling.

Calculate the amount of income tax that Mr Amir has to pay if his annual income is $65 000.
12. The diagram below shows a parallelogram $ACDE$. $CE$ is the diagonal of $ACDE$ and $CE$ meets $BD$ at $F$.

(a) Prove that triangle $BCF$ and triangle $DEF$ are similar.  

(b) Given that $3DE = 5BC$ and $CF = 6.3$ cm, find the length of $EF$.  

(c) Find  

(i) $\frac{\text{area of triangle } BCF}{\text{area of triangle } DEF}$  

(ii) $\frac{\text{area of triangle } BCF}{\text{area of triangle } FCD}$  

(iii) $\frac{\text{area of triangle } BCF}{\text{area of parallelogram } ACDE}$  

[2]
13. Use the data below,  

   24, 20, 18, 25, 22, 32, 30, 29, 35, 30, 28, 24, 38

   (a) to create a box-and-whisker plot for the data.  [1]

   (b) What is the range?  [1]
Section B (8 marks)

Answer one question from this section. Each question carries 8 marks.

[moderate]

14. (a) A triangle in the diagram below is not drawn to scale. It has the following measurements;

\[ AB = 5 \text{ cm}, \ AC = 12 \text{ cm} \text{ and } BC = 13 \text{ cm}. \]

(i) Give a reason why angle \( BAC \) is a right-angled.

AC is produced to \( E \) such that \( CE = 4 \text{ cm} \). Triangle \( ABC \) is similar to triangle \( AED \).

(i) Calculate \( BD \)

(ii) Find the exact value of \( \cos \angle ADE \).

(b) Calculate the value of \( x \) in the diagram below.
15. The cumulative frequency curve below shows the weights of 120 children of the same age group at Village A.

(a) Refer to the graph.

Find

(i) the median weight, [1]

(ii) the inter-quartile range, [2]

(iii) the 80<sup>th</sup> percentile. [1]

(iv) the number of children who weigh more than 50 kg. [1]
(v) The grouped frequency distribution of the weights of the 120 children is shown below. Find the value of $k$.

<table>
<thead>
<tr>
<th>Weight $(x)$</th>
<th>Frequency</th>
</tr>
</thead>
<tbody>
<tr>
<td>$0 \leq x &lt; 10$</td>
<td>4</td>
</tr>
<tr>
<td>$10 \leq x &lt; 20$</td>
<td>12</td>
</tr>
<tr>
<td>$20 \leq x &lt; 30$</td>
<td>$k$</td>
</tr>
<tr>
<td>$30 \leq x &lt; 40$</td>
<td>44</td>
</tr>
<tr>
<td>$40 \leq x &lt; 50$</td>
<td>26</td>
</tr>
<tr>
<td>$50 \leq x &lt; 60$</td>
<td>10</td>
</tr>
</tbody>
</table>

[1]

(vi) If 2 children are chosen, what is the probability that one weighs less than 20 kg and the other weighs more than 50 kg.

[2]