F.3 Second Term Examination
Mathematics (Paper 1)

Name: ____________________ Class: ______ No.: ______

Time Allowed: 90 minutes

This paper consists of 3 sections. Write your answers in the spaces provided.
Total Marks: 100

Section A (20 marks)

Answer ALL questions in this section. Each question carries 2 marks.
Working steps are NOT required in this section.

1. The heights of two similar pyramids are 9 cm and 15 cm respectively. Find the ratio of their surface areas.

2. Find the diameter of a sphere if its volume is $36\pi \text{ cm}^3$.

3. Find the value of $\tan 60^\circ - \cos 30^\circ$ without using a calculator and leave your answer in surd form.

4. As John walks 13 m up a slope, he rises by 5 m.
Express the gradient of the slope as a fraction.

5. Express the true bearing 125° as a compass bearing.

6. Given that $M$ is the mid-point of $P(-3, 6)$ and $Q(-1, -2)$, find the coordinates of $M$.

7. The following table shows the heights of 10 boys.

<table>
<thead>
<tr>
<th>Height (cm)</th>
<th>150</th>
<th>151</th>
<th>152</th>
<th>153</th>
<th>154</th>
</tr>
</thead>
<tbody>
<tr>
<td>No. of boys</td>
<td>1</td>
<td>2</td>
<td>2</td>
<td>3</td>
<td>2</td>
</tr>
</tbody>
</table>

Find the median height of the 10 boys.
8. Given that the arithmetic mean of five numbers \(a, b, c, d\) and \(e\) is 16, find the arithmetic mean of \(3a, 3b, 3c, 3d\) and \(3e\).

9. A bag contains 12 white balls and 18 black balls. If a ball is drawn from the bag at random, find the probability that the ball drawn is a white ball.

10. When tossing two dice, find the probability of getting a sum of 12.

Section B (50 marks)
Answer ALL questions in this section. Each question carries 5 marks.
Working steps MUST be shown in answering questions in this section.
Unless otherwise specified, give your answers correct to 3 significant figures if necessary.

11. The figure shows a square-based frustum \(ABCDEF\) which is formed by removing the right pyramid \(VEF\) from the right pyramid \(VABCD\). Find the volume of the frustum.
12. In the figure, a piece of paper in the shape of a sector with radius 9 cm is folded to form a hollow right circular cone.
(a) Find the base radius of the cone.

(b) Find the height of the cone.

13. Simplify the expression \( \tan^2 \theta - \frac{1}{\cos^2 \theta} \).
14. In the figure, $ABCD$ is a rectangle, $DC = 10$ cm, $PC = 5$ cm and $AP = 15$ cm. Find $\angle APD$.

15. In the figure, two ships $A$ and $B$ leave port $P$ at the same time. Ship $A$ sails in the direction N15°E at 25 km/h and ship $B$ sails in the direction S75°E at 18 km/h. Find the distance between ships $A$ and $B$ after 5 hours.
16. In the figure, $P$ is a point on line segment $AB$ such that $AP : PB = 2 : 1$ where $A = (-5, 0)$ and $B = (7, 9)$, find the coordinates of $P$.

17. The figure shows $\triangle OAB$ with vertices $O(0, 0)$, $A(a, a)$ and $B(2a, 0)$. Prove that $\triangle OAB$ is an isosceles right-angled triangle.
18. The mode of five integers 12, 11, 9, 15, $3x + 2$ is 11.
   (a) Find the value of $x$.

   (b) Find the arithmetic mean and median of the five integers.

19. One letter is taken from each of the words ‘FOR’, ‘OF’ and ‘IF’ at random.
   (a) List all the possible outcomes.

   (b) Find the probability that exactly two letters taken are the same.
20. There are two $10 notes, three $20 notes and a $50 note in a wallet. Joe takes a note from the wallet at random.
   (a) Find the probability that a $20 note is drawn.

   (b) Find the expected value of the note that Joe draws.

Section C (30 marks)
Answer ALL questions in this section. Each question carries 10 marks.
Working steps MUST be shown in answering questions in this section.
Unless otherwise specified, give your answers correct to 3 significant figures if necessary.

21. A test tube has a shape of a hollow cylinder with a hollow hemisphere as its base. The radius of the hemisphere is 1 cm and the outer surface area of the test tube is \(26\pi \text{ cm}^2\).
   (a) Find the height of the test tube. (4 marks)
(b) Find the volume of the test tube in terms of $\pi$.  

(3 marks)

(c) If the test tube is half filled with water, find the height of water in the test tube.  

(3 marks)
22. In the figure, the angle of elevation of the top \((P)\) of building \(PQ\) from point \(A\) on the horizontal ground is \(45^\circ\). After moving towards the building for 10 m to point \(B\), the angle of elevation is \(60^\circ\).

(a) Let \(h\) m be the height of the building, express \(AQ\) and \(BQ\) in terms of \(h\). (Leave your answers in surd form if necessary.) (4 marks)

(b) Find the height of the building. (3 marks)
(c) If $M$ is the mid-point of $AQ$, will the angle of elevation of $P$ from $M$ be larger than that from point $B$. Explain your answer briefly. (3 marks)

23. The figure shows a cumulative frequency polygon of the marks of 40 students in a Mathematics test.

![Cumulative Frequency Polygon](image)

(a) Find the median mark of the 40 students. (1 mark)

(b) Complete the following frequency distribution table. (4 marks)

<table>
<thead>
<tr>
<th>Marks</th>
<th>Class Mark</th>
<th>Frequency</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 - 10</td>
<td></td>
<td>0</td>
</tr>
<tr>
<td>11 - 20</td>
<td></td>
<td>10</td>
</tr>
<tr>
<td>21 - 30</td>
<td>25.5</td>
<td></td>
</tr>
<tr>
<td>31 - 40</td>
<td>35.5</td>
<td></td>
</tr>
<tr>
<td>41 - 50</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
(c) Find the modal class of the marks of the 40 students.  

(1 mark)

(d) Find the mean mark of the 40 students.  

(2 marks)

(e) If one student is selected at random, find the probability that the student scores 30.5 marks or more.  

(2 marks)

— End of paper —