Annual Examinations for Secondary Schools 2014

FORM 4  MATHEMATICS TRACK 3  TIME: 20 minutes
Non Calculator Paper

<table>
<thead>
<tr>
<th>Name: ________________________________</th>
<th>Class: ________________</th>
</tr>
</thead>
</table>

Instructions to Candidates

- Answer ALL questions.
- This paper carries a total of 20 marks.
- Each question carries one mark except for question no. 18 which carries two marks.
- Calculators and protractors are NOT ALLOWED.
<table>
<thead>
<tr>
<th>No.</th>
<th>QUESTION</th>
<th>Space for Working if Required</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Write 0.00035 in standard form.</td>
<td></td>
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<tr>
<td></td>
<td>Ans: __________________</td>
<td></td>
</tr>
<tr>
<td>2.</td>
<td>Given that $2^x = \frac{1}{32}$, find the value of $x$.</td>
<td></td>
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<tr>
<td></td>
<td>Ans: $x =$ ___________</td>
<td></td>
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<tr>
<td>3.</td>
<td>Julian travels 150 km in $2\frac{1}{2}$ hours. Calculate his average speed.</td>
<td></td>
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<tr>
<td></td>
<td>Ans: ___________ km/h</td>
<td></td>
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<tr>
<td>4.</td>
<td>The members of a club increased from 120 to 132. What is the percentage increase?</td>
<td></td>
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<tr>
<td></td>
<td>Ans: ___________%</td>
<td></td>
</tr>
<tr>
<td>5.</td>
<td>If $3x^2 + 2x = 40$ then $15x^2 + 10x =$ ________</td>
<td></td>
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<tr>
<td></td>
<td>Choose the correct answer:</td>
<td></td>
</tr>
<tr>
<td></td>
<td>A. 120   B. 200   C. 280   D. 570   E. 578</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Ans: ___________</td>
<td></td>
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<tr>
<td>6.</td>
<td>Find the value of $x$, given that $6 \times 7 \times 8 \times 9 = \frac{12 \times 14 \times 18}{x}$.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Ans: $x =$ ___________</td>
<td></td>
</tr>
<tr>
<td>7.</td>
<td>Simplify: $\sqrt{\frac{9a^2b^6}{16}}$</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Ans: ___________</td>
<td></td>
</tr>
<tr>
<td>8.</td>
<td>Work out: $98^2 - 2^2$</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Ans: ___________</td>
<td></td>
</tr>
<tr>
<td>No.</td>
<td>QUESTION</td>
<td>Space for Working if Required</td>
</tr>
<tr>
<td>-----</td>
<td>--------------------------------------------------------------------------</td>
<td>--------------------------------</td>
</tr>
<tr>
<td>9.</td>
<td>If ( \frac{m}{q} = \frac{3}{4} ) and ( \frac{m}{n} = \frac{3}{8} ), find the value of ( \frac{n}{q} ).</td>
<td>Ans: __________________</td>
</tr>
<tr>
<td>10.</td>
<td>Calculate the area of the following trapezium.</td>
<td>Ans: ______________ cm²</td>
</tr>
<tr>
<td></td>
<td>![Diagram of Trapezium]</td>
<td></td>
</tr>
<tr>
<td>11.</td>
<td>Work out ( (4.2 \times 10^6) \times (5 \times 10^{-2}) ). Give your answer in standard form.</td>
<td>Ans: ______________</td>
</tr>
<tr>
<td>12.</td>
<td>Write three different numbers that have a mean of 7.</td>
<td>Ans: ______. ______. ______</td>
</tr>
<tr>
<td>13.</td>
<td>Simplify: ( \frac{2p^2 - 2pq}{pq - q^2} )</td>
<td>Ans: ______________</td>
</tr>
<tr>
<td>14.</td>
<td>What is the gradient of the line given by ( 4x - 2y + 5 = 0 )?</td>
<td>Ans: ______________</td>
</tr>
<tr>
<td>15.</td>
<td>ABCD is a square. Which one of the following is FALSE?</td>
<td></td>
</tr>
<tr>
<td></td>
<td>A. The diagonals bisect each other at right angles.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>B. The diagonals are equal in length.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>C. ABCD has rotational symmetry of order 2.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>D. ABCD is a parallelogram.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Ans: ______________</td>
<td></td>
</tr>
</tbody>
</table>
16. Expand: \((2x - 3)(x + 5)\)  
Ans: ____________________

17. Fill in the missing command of the LOGO program that traces the following diagram.

```
PD RT 90 FD 70 LT 60 FD 70 RT 120 FD 70 ________ FD 70 PU
```

18. The frequency table shows the distribution of ages of 200 people at a restaurant.

<table>
<thead>
<tr>
<th>Age</th>
<th>0 &lt; A ≤ 20</th>
<th>20 &lt; A ≤ 40</th>
<th>40 &lt; A ≤ 60</th>
<th>60 &lt; A ≤ 80</th>
<th>80 &lt; A ≤ 100</th>
</tr>
</thead>
<tbody>
<tr>
<td>Frequency</td>
<td>20</td>
<td>75</td>
<td>70</td>
<td>30</td>
<td>5</td>
</tr>
</tbody>
</table>

(a) Which class interval contains the median age?  
Ans: ______________

(b) What is the modal class?  
Ans: ______________

19. Water is poured at a constant rate into each of the four containers shown below.

```
A   B   C   D
```

The graph shows how the height of water in a container varies with time as the water is poured in one of the above containers.

Which container does the graph refer to?  
Ans: ______________
CALCULATORS ARE ALLOWED BUT ALL NECESSARY WORKING MUST BE SHOWN.

ANSWER ALL QUESTIONS.

Table of Formulae

Curved Surface Area of Right Circular Cone \( \pi rl \)
Surface Area of a Sphere \( 4\pi r^2 \)
Volume of a Pyramid/Right Circular Cone \( \frac{1}{3} \text{ base area } \times \text{ perpendicular height} \)
Volume of Sphere \( \frac{4}{3} \pi r^3 \)
Solutions \( ax^2 + bx + c = 0 \) \( x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a} \)
1. Equilateral triangles were used to make the shapes below. Each equilateral triangle has side 1 cm.

![Shapes](image)

a) Complete the following table:

<table>
<thead>
<tr>
<th>Shape Number</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
</tr>
</thead>
<tbody>
<tr>
<td>Perimeter of shape, in cm</td>
<td>5</td>
<td>8</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

b) Find the perimeter of:

(i) shape number 10.

Ans. ________ cm

(ii) shape number \(n\).

Ans. ________ cm

c) Sarah says “I can draw a shape with a perimeter of 47 cm.” Is Sarah correct? Give a reason for your answer.

________________________________________________________________________

________________________________________________________________________

________________________________________________________________________

________________________________________________________________________

________________________________________________________________________

(7 marks)
2. The diagram shows a cylindrical concrete structure with a hollow hemisphere in the middle. The cylindrical structure is 0.6 m high and has a diameter of 1.7 m. The hollow hemisphere has a diameter of 1 m.

![Diagram of cylindrical concrete structure with hollow hemisphere]

a) Calculate the volume of the hollow hemisphere. Give your answer correct to 2 decimal places.

Ans. _________ m³

b) Calculate the volume of concrete used to construct the structure. Give your answer correct to 2 decimal places.

Ans. _________ m³
3. a) Jacob made **one error** while solving an equation.
(i) Underline the error.
(ii) Solve the equation correctly, showing all the steps.

**Jacob's work:**
\[ 9 + x(x + 20) = 7(x - 3) \]
\[ 9 + x^2 + 20x = 7x - 21 \]
\[ x^2 + 13x + 12 = 0 \]
\[ (x + 1)(x + 12) = 0 \]
\[ x = -1 \quad \text{or} \quad x = -12 \]

**Solution:**
\[ 9 + x(x + 20) = 7(x - 3) \]

b) Solve the equation:
\[ \frac{x+3}{4} - \frac{x+2}{3} = \frac{1}{2} \]

Ans. \( x = \) __________

c) The surface area of a cylinder is given by \( A = 2\pi r(r + h) \).
Make \( h \) the subject of the formula.

\[ \text{Ans.} \ h = \] __________

__________________________________________________________

(10 marks)
4. Solve the equation \(2x^2 - 3x - 4 = 0\), giving your answer correct to 2 decimal places.

\[
\text{Ans. } x = \phantom{0} \phantom{0}
\]

\[
\text{Ans. } x = \phantom{0} \phantom{0}
\]

5. Two children are to be chosen at random from a group of 24 boys and 12 girls.

a) Complete the probability tree diagram below:

\[
P(B) = \frac{24}{36}
\]

\[
P(G) = \frac{12}{35}
\]

b) Using the probability tree or otherwise, find the probability that:

(i) two boys are chosen.

\[
\text{Ans. } \phantom{0} \phantom{0}
\]

(ii) a boy and a girl are chosen.

\[
\text{Ans. } \phantom{0} \phantom{0}
\]
6. The graph of \( y = x^2 - 3x - 1 \) is shown on the grid below.

![Graph of \( y = x^2 - 3x - 1 \)]

a) (i) Point \( A \) is on the curve with equation \( y = x^2 - 3x - 1 \).
Find the \( y \) coordinate of \( A \) given that \( x = 4 \).

\[ \text{Ans. } A(4, \ldots) \]

(ii) Mark point \( A \) on the grid above and complete the graph of \( y = x^2 - 3x - 1 \).
b) **Complete** the table for \( y = -\frac{1}{2} x + 2 \) and **draw** the graph on the grid on page 6.

\[
\begin{array}{|c|c|c|}
\hline
x & -2 & 1 & 4 \\
\hline
y & 1.5 &  \ &  \\
\hline
\end{array}
\]

\[
\begin{align*}
\text{Draw the graph on page 6.}
\end{align*}
\]

\[
\begin{align*}
\text{Complete the table for } y = -\frac{1}{2} x + 2 \\
\text{and draw the graph on the grid on page 6.}
\end{align*}
\]

\[
\begin{align*}
\text{Use the graph to solve the simultaneous equations:}
\end{align*}
\]

\[
\begin{align*}
y &= x^2 - 3x - 1 \\
y &= -\frac{1}{2} x + 2
\end{align*}
\]

\[
\begin{align*}
x = \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_, \ y = \_\_\_\_\_\_\_\_\_\_\_\_\_\_, \ x = \_\_\_\_\_\_\_\_\_\_\_, \ y = \_\_\_\_\_\_\_\_\_\_\_
\end{align*}
\]

d) Which one of the following lines does **NOT** intersect the curve \( y = x^2 - 3x - 1 \)? Explain your reasoning.

A. \( y = -\frac{1}{2} x - 5 \)
B. \( y = -\frac{1}{2} x + 5 \)
C. \( y = -\frac{1}{2} x \)

Line _____

Reason: _______________________________________________________________________
_____________________________________________________________________________
_____________________________________________________________________________

_____________________________________________________________________________

_____________________________________________________________________________

(8 marks)

7. Louise invests €3000 in an account which pays **compound interest** at 5% per annum. Find how many complete years she will have to leave the money in the account for it to become at least €3600.

Ans. ________

(3 marks)
8.

a) Draw the reflection of triangle A in the line $x = 3$. Label the image B.

b) Rotate triangle A by 90° anticlockwise about the point $(-1, -1)$. Label the image C.

c) Enlarge triangle A by scale factor $\frac{1}{2}$, using centre of enlargement $(-1, -1)$. Label the image D.

d) Which of triangles B, C and D is not congruent to triangle A?

Ans. _________

________________________________________________________________________ (6 marks)
9. The points P, Q, R and S lie on the circumference of a circle centre O. RT is a tangent to the circle. Angle O\(\hat{P}Q\) = 30° and angle O\(\hat{Q}R\) = 43°.

a) Find the size of the angles marked \(a\), \(b\) and \(c\). Give reasons for your answers.

\[\text{Angle } a = \ldots\]

Reason

\[\text{Angle } b = \ldots\]

Reason

\[\text{Angle } c = \ldots\]

Reason

b) Show that angle \(\hat{QRT} = 47°\).

________________________________________________________________________(8 marks)
10. The diagram shows the top view of a circular pool. The shaded area is a step inside the pool. The radius OA = 2.5 m, OC = 1.5 m and AB = 4 m.

a) Calculate angle AÔB, giving your answer correct to 1 decimal place.

Ans. ________

b) Calculate the area of the step. Give your answer correct to 4 significant figures.

Ans. ______________ m²

c) Calculate the area of the pool where it is deep (i.e. the unshaded area). Give your answer correct to 4 significant figures.

Ans. ______________ m²
d) The pool is filled with water, such that the deeper part is 0.4 m deep. The step is 0.2 m below the surface of the water. Calculate the volume of water needed to fill the pool. Give your answer correct to the nearest litre.

Ans. _________ litres

(10 marks)

11. The diagram shows a bridge AD. AG = 42 m, BC = 50 m, CD = 22 m and CE = 28 m. Angle AGB = 35°.

\[ \text{AB} = \ldots \text{m} \]

\[ \text{DE} = \ldots \text{m} \]

b) Calculate the angle of elevation of E from G, giving your answer correct to 1 decimal place.

Ans: ________°

(8 marks)
12. **In this question use ruler and compasses only.**

a) Construct the locus of points that are 6 cm from point X.

b) Construct the locus of points that are equidistant from points C and D.

c) Shade the region consisting of all points inside rectangle ABCD that are more than 6 cm from X and nearer to C than to D.