ST EDWARD’S
OXFORD

16+ ENTRANCE EXAMINATION

For entry in
September 2018

Mathematics
Time: 1 hour

Candidates Name: ..................................................

Instructions to Candidates

- 65 Marks
- Time allowed 1 Hour
- Calculators are allowed
- Write all answers, including your workings, in this booklet
You may use the following formulae:

**Volume of prism** = area of cross section × length

**Volume of sphere** = \( \frac{4}{3} \pi r^3 \)

**Surface area of sphere** = \( 4\pi r^2 \)

**Volume of cone** = \( \frac{1}{3} \pi r^2 h \)

**Curved surface area of cone** = \( \pi rl \)

**In any triangle** \( ABC \)

**Sine Rule** \( \frac{a}{\sin A} = \frac{b}{\sin B} = \frac{c}{\sin C} \)

**Cosine Rule** \( a^2 = b^2 + c^2 - 2bc \cos A \)

**Area of triangle** = \( \frac{1}{2} ab \sin C \)

**The Quadratic Equation**

The solutions of \( ax^2 + bx + c = 0 \) where \( a \neq 0 \), are given by \( x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a} \).
The diagram shows a right-angled triangle $ABC$.
$AC = 12.6$ m.
Angle $CAB = 41^\circ$
Angle $ABC = 90^\circ$

Find the length of the side $AB$. Give your answer correct to 3 significant figures.
2. A spaceship travelled for $6 \times 10^2$ hours at a speed of $8 \times 10^4$ km/h.

(a) Calculate the distance travelled by the spaceship.
   Give your answer in standard form.

........................................................................ km

(b) One month an aircraft travelled $2 \times 10^5$ km.
The next month the aircraft travelled $3 \times 10^4$ km.

(b) Calculate the total distance travelled by the aircraft in the two months.
   Give your answer as an ordinary number.

........................................................................ km

(Total 5 marks)
3. This table shows some expressions. The letters \(a\), \(b\), \(c\), and \(d\) represent lengths. \(\pi\) and 4 are numbers that have no dimensions. Three of the expressions could represent volumes.

Tick the boxes underneath the three expressions which could represent volumes.

<table>
<thead>
<tr>
<th>(\frac{abc}{d})</th>
<th>(4\pi a^3)</th>
<th>(4a^2)</th>
<th>(\pi a^3 + bd)</th>
<th>((a + b)cd)</th>
<th>(\pi(c^2 + d^2))</th>
<th>(4ad^2)</th>
</tr>
</thead>
<tbody>
<tr>
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</tbody>
</table>

(Total 3 marks)

4.

(a) On the grid, rotate triangle \(A\) 180° about \(O\). Label your new triangle \(B\).

(b) On the grid, enlarge triangle \(A\) by scale factor \(\frac{1}{2}\), centre \(O\). Label your new triangle \(C\).

(Total 5 marks)
5. Convert the recurring decimal $0.\overline{29}$ to a fraction.

6. (a) $-2 < x \leq 1$

$x$ is an integer.

Write down all the possible values of $x$.

(b) $-2 < x \leq 1 \quad y > -2 \quad y < x + 1$

$x$ and $y$ are integers.

On the grid, mark with a cross (\(\times\)), each of the six points which satisfies all these 3 inequalities.

(Total 5 marks)
7. (a) Solve \( 6x + 2 = 4(x - 7) \)

\[ x = \ldots \ldots \ldots \ldots \]

(b) (i) Factorise \( x^2 - 23x + 42 \)

(ii) Hence solve \( x^2 - 23x + 42 = 0 \)

(c) Factorise \( (x + y)^2 - 3(x + y) \)

(Total 9 marks)
The diagram shows a trapezium. The measurements on the diagram are in centimetres. The lengths of the parallel sides are $x$ cm and 20 cm. The height of the trapezium is $2x$ cm.

The area of the trapezium is 400 cm$^2$.

(a) Show that

$$x^2 + 20x = 400$$

(b) Find the value of $x$. Give your answer correct to 3 decimal places.
9. The fraction, \( p \), of an adult's dose of medicine which should be given to a child who weighs \( w \) kg is given by the formula

\[
p = \frac{3w + 20}{200}
\]

(a) Use the formula \( p = \frac{3w + 20}{200} \) to find the weight of a child whose dose is the same as an adult’s dose.

\[
\text{………………… kg} \quad (3)
\]

(b) Make \( w \) the subject of the formula \( p = \frac{3w + 20}{200} \)

\[
w = \text{…………………} \quad (3)
\]

\[
\frac{3w + 20}{200} = \frac{A}{A + 12}
\]

(c) Express \( A \) in terms of \( w \).

\[
A = \text{…………………} \quad (4)
\]

(Total 10 marks)
10. Solve the equation

$$\frac{7}{x + 2} + \frac{1}{x - 1} = 4$$

(Total 7 marks)
11. $CDEF$ is a quadrilateral with $\overrightarrow{CD} = \mathbf{a}$, $\overrightarrow{DE} = \mathbf{b}$ and $\overrightarrow{FC} = \mathbf{a} - \mathbf{b}$.

(a) Express $\overrightarrow{CE}$ in terms of $\mathbf{a}$ and $\mathbf{b}$.

…………………….. (1)

(b) Prove that $\overrightarrow{FE}$ is parallel to $\overrightarrow{CD}$.

………………………………………………………………………………………………………………………………………………………………………………………………………… (2)

$M$ is the midpoint of $DE$.

(c) Express $\overrightarrow{FM}$ in terms of $\mathbf{a}$ and $\mathbf{b}$.

…………………….. (1)
$X$ is the point on $FM$ such that $FX : XM = 4 : 1$.

(d) Prove that $C, X$ and $E$ lie on the same straight line.

12. The depth, $D$ metres, of the water at the end of a jetty in the afternoon can be modelled by this formula

\[ D = 5.5 + A \sin 30(t - k)\circ \]

Where $t$ hours is the number of hours after midday, $A$ and $k$ are constants.

Yesterday the low tide was at 3 p.m.
The depth of water at low tide was 3.5 m.

Find the value of $A$ and $k$.

\[ A = \ldots \ldots \ldots \ldots \ldots \ldots \]

\[ k = \ldots \ldots \ldots \ldots \ldots \ldots \]

(Total 4 marks)