Year 10 Mathematics Practice Exam #2

Time: 2 hours

Sections

<table>
<thead>
<tr>
<th>Topic</th>
<th>Page</th>
<th>Result</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Number</strong></td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>Base skills: percentages; fractions; decimals; ratios; proportional thinking</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Higher level: multiple step problems; percentage change; standard form</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Algebra</strong></td>
<td>5</td>
<td></td>
</tr>
<tr>
<td>Base skills: simplifying; expanding and factorising, including quadratics; solving linear</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Higher level: solving with fractions and quadratics; writing equations in context; roots of terms</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Graphs</strong></td>
<td>8</td>
<td></td>
</tr>
<tr>
<td>Base skills: reading graphs in a context; plotting lines; using rules for patterns</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Higher level: equations of lines; plot a parabola; finding rules for patterns</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Measurement</strong></td>
<td>10</td>
<td></td>
</tr>
<tr>
<td>Base skills: perimeters and areas of triangles, quadrilaterals and circles; unit conversions</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Higher level: shapes composed of fractional or multiple simple shapes; rates; volumes; time</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Trigonometry</strong></td>
<td>13</td>
<td></td>
</tr>
<tr>
<td>Base skills: Pythagoras; finding a side using Trig</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Higher level: multiple step problems; situations without right angle given at the start</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Overall Grade</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

It is expected that working is shown for all questions.
Number

For marker’s use only

<table>
<thead>
<tr>
<th>Achieved</th>
<th>Merit</th>
<th>Excellence</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

QUESTION ONE

Put in a >, < or = sign to indicate which is bigger and which is smaller

a) \(6.42 \times 10^4\) \(6.085 \times 10^5\)
b) \(4.3 \times 10^{-2}\) \(7 \times 10^{-3}\)
c) \(-\frac{41}{2}\) \(-3.5\)

QUESTION TWO

Sue and Ben split the profits of their on-line tutoring business in the ratio of \(S:B\) of 3 : 2.

a) If Sue gets $900 after the split, how much would Ben get?

____________________________________

b) If they have $840 to split, how much goes to Sue and how much to Ben?

____________________________________

____________________________________

QUESTION THREE

22% of a school’s students are in Year 10.
If the school has 841 students, how many are in Year 10?

____________________________________

____________________________________

QUESTION FOUR

Jim has 5 pairs of shoes for sport, 2 pairs for school and 7 other pairs.
What percentage of his shoes are for school?

____________________________________

____________________________________

QUESTION FIVE

Jim buys a post that is 4.2 metres long. After he puts it into a hole that is 1.4 metres deep, how much will be above ground?

____________________________________

____________________________________

QUESTION SIX

Eagle Co. made a $560,000 profit in 2018.

a) They increased profit by 5% in 2019. How much was the new profit?

____________________________________

____________________________________

b) If the 2018 profit was an increase of 7% over the 2017 profit, how much was the 2017 profit?

____________________________________

____________________________________
**QUESTION SEVEN**

Light travels \(3 \times 10^9\) metres per second.  
The earth is \(1.5 \times 10^{12}\) metres from the sun.  
How long does light take to get from the sun to the earth?

\[
\text{____________________________________} \\
\text{____________________________________} \\
\text{____________________________________} \\
\text{____________________________________}
\]

**QUESTION EIGHT**

Eagle Co. make eagle badges.  
Each badge uses 6g of silver.  
Silver costs $80 per 100g.  

a) If Eagle Co. have $400 worth of silver, how many badges can they make?

\[
\text{____________________________________} \\
\text{____________________________________} \\
\text{____________________________________} \\
\text{____________________________________}
\]

b) Eagle Co. pay their workers $18 for every badge they make.  
   It takes Billy five-eighths of an hour to make a badge.  
   If Billy makes badges for 35 hours in a week, how much will he be paid in that week?

\[
\text{____________________________________} \\
\text{____________________________________} \\
\text{____________________________________} \\
\text{____________________________________}
\]

**QUESTION NINE**

Ryan eats two-thirds of his pizza. Emily eats half of her pizza. Because their pizzas are different sizes, they eat the same amount.  
What is the ratio of the size of Ryan’s pizza to Emily’s pizza?

\[
\text{____________________________________} \\
\text{____________________________________} \\
\text{____________________________________} \\
\text{____________________________________}
\]

**QUESTION TEN**

The usual price of Eagle Co. necklaces is $85.  

a) If they decide that they are going to have a “20% off” sale, how much will they sell for?

\[
\text{____________________________________} \\
\text{____________________________________} \\
\text{____________________________________} \\
\text{____________________________________}
\]

b) If instead they decide that they are going to sell them for $65, how much is the discount as a % from the $85?

\[
\text{____________________________________} \\
\text{____________________________________} \\
\text{____________________________________} \\
\text{____________________________________}
\]

**QUESTION ELEVEN**

A file is one quarter downloaded.  
After 2 more minutes it is two-fifths downloaded.  
How much longer will the file take to download if it continues as the same rate?

\[
\text{____________________________________} \\
\text{____________________________________} \\
\text{____________________________________} \\
\text{____________________________________}
\]
QUESTION TWELVE

Graham is going to make blueberry muffins to sell at a cake stall.

The recipe uses:
- 200 grams of blueberries
- 200 grams flour
- 150 grams sugar
- 120 ml milk
- 1 large egg
- oil, salt, baking powder, vanilla etc

This recipe makes eight muffins.

He will use three 500 gram packs of blueberries, which cost $4.95 each.
Flour costs $1.70 for a 1000 gram bag.
Sugar costs $3.60 for a 1500 gram bag.
Milk costs $2.35 for a 1000 ml bottle.
Eggs cost $4.90 for 10.
The rest he already has (oil etc)

He wants to earn $150 after costs are paid for.

How much should he sell each muffin for?

QUESTION THIRTEEN

Jim wants to start a mowing business.

He thinks he can work 30 hours a week (the rest is travelling, repairs etc) for 48 weeks of the year.

He wants to charge his clients $60 an hour.

He estimates that his ratio of costs : profit (petrol, equipment etc) is 2 : 5 for that hourly rate.

However he only gets what remains after the 15% GST (tax) that is due on his profit is taken off. (He gets back the GST due on the costs).

How much will he earn in a year if his figures are correct?
QUESTION ONE

Calculate the following expressions if $p = 3$, $q = -2$

a) $2pq = \phantom{0000}$

b) $q + p = \phantom{0000}$

QUESTION TWO

Solve these equations. Show your working.

a) $5 = x + 12$

b) $5x + 18 = 10$

c) $16 = 4(x + 2)$

d) $8x + 11 = 5x + 19$

e) $\frac{x + 6}{3} = x + 4$

QUESTION THREE

You must write equations and solve them for these questions. Show all working.

a) An octagon has a perimeter of 36 cm. How long are the side lengths?

b) Bill starts with some money. He gets $20 more, then doubles that new amount. He now has $140. How much did he start with?
c) Three numbers average to 50.
   The smaller one is 30 less than the biggest one.
   The middle one is twenty five more than the smallest one.
   What are the three numbers?
   ____________________________
   ____________________________
   ____________________________
   ____________________________
   ____________________________

**QUESTION FOUR**

The molecular weight of an amine can be found by the formula:

\[ W = 12C + 14N + H \]

where \( W \) is the molecular weight, \( C \) is the number of carbon atoms, \( N \) the number of nitrogen atoms and \( H \) the number of hydrogen atoms.

a) Ethyldiamine is \( \text{CH}_2\text{NH}_2\text{CH}_2\text{NH}_2 \), so has two carbons, two nitrogens and eight hydrogens.
   What is its molecular weight?
   ____________________________
   ____________________________
   ____________________________
   ____________________________
   ____________________________

b) 2-aminopentane has a molecular weight of 87. It has one nitrogen and 13 hydrogens.
   How many carbons does it have?
   ____________________________
   ____________________________
   ____________________________
   ____________________________
   ____________________________

**QUESTION FIVE**

Simplify the following expressions:

a) \( 4d - d = \) ____________
   ____________________________
   ____________________________
   ____________________________
   ____________________________
   ____________________________

b) \( h \times h \times h \times h = \) ____________
   ____________________________
   ____________________________
   ____________________________
   ____________________________
   ____________________________

c) \( 2x + 3x^2 - 8x + 5x^2 = \) ____________
   ____________________________
   ____________________________
   ____________________________
   ____________________________
   ____________________________

d) \( 3p \times 5 = \) ____________
   ____________________________
   ____________________________
   ____________________________
   ____________________________
   ____________________________

e) \( (5x^3)^2 = \) ____________
   ____________________________
   ____________________________
   ____________________________
   ____________________________
   ____________________________

**QUESTION SIX**

Expand, and simplify if appropriate

a) \( 4(5 + x) = \) ____________
   ____________________________
   ____________________________
   ____________________________
   ____________________________
   ____________________________

b) \( x(5x + 3) = \) ____________
   ____________________________
   ____________________________
   ____________________________
   ____________________________
   ____________________________

c) \( -2x(x + 3) = \) ____________
   ____________________________
   ____________________________
   ____________________________
   ____________________________
   ____________________________

d) \( 2(x - 3) + 4(x + 10) = \) ____________
   ____________________________
   ____________________________
   ____________________________
   ____________________________
   ____________________________

e) \( (x + 5)(x + 4) = \) ____________
   ____________________________
   ____________________________
   ____________________________
   ____________________________
   ____________________________
QUESTION SEVEN
Factorise fully

a) \(4x + 20 = \) ______________

b) \(a^2 + ab = \) ______________

c) \(10x^2 + 15x = \) ______________

d) \(x^2 + 15x + 50 = \) ______________

e) \(x^2 + 5x - 66 = \) ______________

QUESTION EIGHT
Write expressions for these statements, with \(n\) as the unknown:

a) A number is multiplied by six and then has ten added.

b) A number is halved after fifteen has been added to it.

QUESTION NINE
A rectangle is 2 cm wider than it is high

\[
\begin{array}{c}
\text{h} \\
\text{h + 2}
\end{array}
\]

a) Write a simplified expression for the perimeter of the rectangle in terms of \(h\).

b) If the perimeter of the rectangle is 161, how high is the rectangle?
(You must solve an equation.)
**QUESTION ONE**

Plot the following points on the grid below:

\( (2, 4), (6, 0), (4, -2), (-2, 8), (0, -6) \)

![Grid with plotted points](image)

**QUESTION TWO**

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>lines</td>
<td>circles</td>
</tr>
<tr>
<td>1</td>
<td>4</td>
</tr>
<tr>
<td>2</td>
<td>7</td>
</tr>
<tr>
<td>3</td>
<td>10</td>
</tr>
</tbody>
</table>

For the pattern above, if it continued:

a) How many circles would you get for ten lines?

b) Write a rule linking the number of circles, \( C \), to the number of lines, \( L \). 

**QUESTION THREE**

The graph shows how full a water tank is, in litres, over a number of hours.

a) How full is the tank at the start?

b) How fast does the tank fill over the first 20 hours?

c) On the graph add lines that show that
   i) the water level does not change between 30 hours and 40 hours.
   ii) from the 40th hour onwards it loses water at 1 litre per hour.

d) What is the equation of the line from the 40th hour onwards?
**QUESTION FOUR**

Trent and Gill start with money in their bank accounts, but spend it over time.

a) When does Gill have the same amount of money as Trent?

b) How can we tell that they spend their money at a constant rate?

c) How much money does Trent have after 15 weeks? Explain how you got your answer.

d) Why does Trent’s line finish at Week 20 and not continue under the x-axis?

**QUESTION FIVE**

Write the equations for the lines above:

a) 

b) 

c) 

**QUESTION SIX**

On the grid above, draw in the lines

a) $y = 5$

b) $y = 3x + 2$

c) $y = \frac{1}{2}x - 2$
Measurement

Formulas
Area of Triangle = ½ b h
Area of Trapezium = \(\frac{a + b}{2} h\)
Area of Circle = \(\pi r^2\)
Circumference = \(\pi d\)

QUESTION ONE
Complete the following conversions:

a) 3.2 km = ________ m
b) 75 mg = ________ g
c) 270 seconds = ________ minutes
d) 2.5 hours = ________ minutes

QUESTION TWO

a) The device shown measures a person’s weight. What units will it use?

b) The height of the Auckland Sky Tower should be measured in what units?

QUESTION THREE

You must put units with the answers to the following questions

a) A golf flag is a triangle with the dimensions shown above. What is the area of the flag?

b) The magnet above has a diameter of 25mm and a depth of 3mm. What is its volume?
QUESTION FOUR
Sandy’s plane is taking off at 1:05 p.m.
a) Write 1:05 p.m. in 24 hour time.

b) The bus she takes to the airport is scheduled to arrive at 11:45 a.m. How long does she have to wait for her plane?

c) If the plane trip lasts 135 minutes, when will it land?

QUESTION FIVE
A garden shed has a sloping roof.
It is 3.2 metres wide, 1.6 metres deep and drops from 2 to 1.8 metres high.
What is the volume of the shed?

QUESTION SIX
These windows are each made of two rectangular sheets of glass and four part circles adding to a semi-circle.
a) The rectangular panes are 50 cm wide and 120 cm high. What is the area of each of the rectangular panes?

b) The part circle pieces have a radius of 50 cm. What is their area?

c) What is the length of the frame – the distance around the outside of all the glass? The shape is shown to the right.
Ben is a sign-writer. He has been paid to paint the logo shown above onto the Eagle Co. main offices.

He is to paint it at a scale of $10 \text{ mm} = 1 \text{ m}$ to the one shown above.

The paint he uses is quite expensive because it needs to not fade, so he doesn’t want to order too much of it. Note, that there are two different colours in the logo.

The paint covers $4.5 \text{ m}^2$ per litre tin.

How many tins of each colour should he order?
QUESTION ONE
Evaluate the expressions:

a) \( \tan(40^\circ) = \) ____________

b) \( \sin^{-1}(0.3) = \) ____________

c) \( \cos^{-1}\left(\frac{3}{7}\right) = \) ____________

QUESTION TWO
Show, using Pythagoras’ Theorem that the following triangle is not right angled.

\[
\begin{array}{c}
15 \\
20 \\
12 \\
\end{array}
\]

\[
\begin{array}{c}
36 \\
50^\circ \\
\end{array}
\]

\[
\begin{array}{c}
\text{if } x = \text{__________}
\end{array}
\]

\[
\begin{array}{c}
\text{if } y = \text{__________}
\end{array}
\]

\[
\begin{array}{c}
\text{if } \angle = \text{__________}
\end{array}
\]

QUESTION THREE
Calculate the unknown side length for each of these triangles:

a)
\[
\begin{array}{c}
27 \\
36 \\
x \\
\end{array}
\]

\[
\text{if } x = \text{__________}
\]

\[
\text{if } \angle = \text{__________}
\]

b)
\[
\begin{array}{c}
x \\
36 \\
50^\circ \\
\end{array}
\]

\[
\text{if } x = \text{__________}
\]

\[
\text{if } \angle = \text{__________}
\]

QUESTION FOUR
Calculate the unknown angle:

\[
\begin{array}{c}
100 \\
55 \\
x^\circ \\
\end{array}
\]

\[
\text{if } \angle = \text{__________}
\]
QUESTION FIVE
Calculate the height of the isosceles triangle shown:

\[ 60 \quad 60 \]
\[ 70 \]

QUESTION SIX
Calculate the unknown angle \( x \) shown in this trapezium.

\[ x^\circ \quad 50 \quad 70 \]
\[ 40 \]

QUESTION SEVEN
Calculate the side length \( l \).

\[ 18 \quad 15 \quad l \]

QUESTION EIGHT
ABCD is a square based pyramid.
AB = BC = 12 and the vertical height is 30.
What is the size of angle between the base and the edges, \( \angle ACE \), shown dotted