



















## Self-Assessment for Grade 11 University Math (MCR3U)

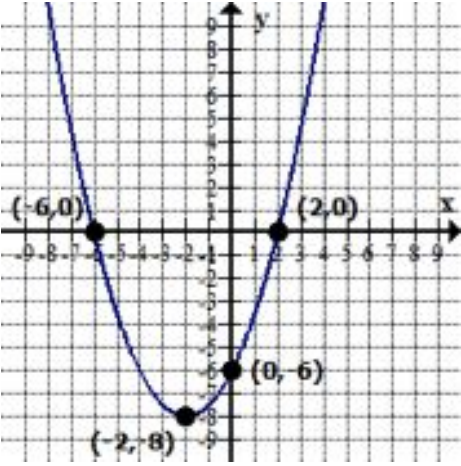






Students who are registered for Grade 11 University Math (MCR3U) may benefit from a self evaluation and review of the following sample of expectations from Grade10 Academic Math (MPM2D).







The questions in this self-assessment reflect some of the key ideas learned in prerequisite courses. They do not represent the problem solving approach or the rich experience that students would be exposed to in a classroom. The intention is for students to revisit some key concepts and, if needed, access review materials in an informal environment at a pace that is comfortable for the student.

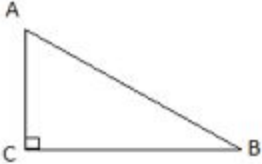



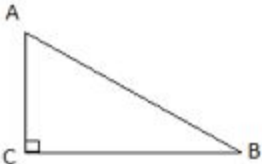






Concept	Sample Question and Answer	How comfortable do you feel with this concept?	Link for further support
I can solve linear systems by graphing or by using the methods of substitution or elimination	1. Solve the system of equations. $4x - 5y = 12$ $6x - 10y = 24$ 2. Some high-school students held a bake sale recently to raise money for a field trip. They charged \$7 for fruit pies and \$10 for meat pies. They sold a total of 52 pies and earned \$424. How many of each type of pie did they sell?	<div style="display: flex; flex-direction: column; align-items: flex-start;"> <div style="display: flex; align-items: center; margin-bottom: 10px;">  <input style="margin-right: 10px;" type="checkbox"/> <span>Very comfortable</span> </div> <div style="display: flex; align-items: center; margin-bottom: 10px;">  <input style="margin-right: 10px;" type="checkbox"/> <span>Somewhat comfortable</span> </div> <div style="display: flex; align-items: center;">  <input style="margin-right: 10px;" type="checkbox"/> <span>Not at all comfortable</span> </div> </div>	<a href="#">Solve Systems of Linear Equations</a>

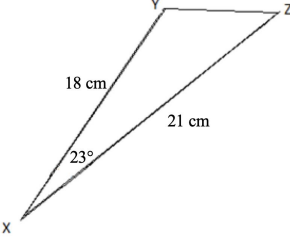






<p>I can identify the key features of a graph of a parabola and use the appropriate terminology to describe them</p>	<p>3. For the quadratic relation <math>y = 2(x + 3)^2 + 4</math>, state the:</p> <p>a) direction of the opening;  b) stretch or compression factor;  c) coordinates of the vertex;  d) equation of the axis of symmetry;  e) y-intercept.  f) Graph the Relation</p>	<p> <input type="checkbox"/> Very comfortable</p> <p> <input type="checkbox"/> Somewhat comfortable</p> <p> <input type="checkbox"/> Not at all comfortable</p>	<p><a href="#">Key Features of a Parabola</a></p>
<p>I can determine the meaning of a negative exponent and of zero as an exponent</p>	<p>4. Evaluate:</p> <p>a) <math>5^0</math>  b) <math>4^{-2}</math></p> <p>5. Describe the significance of any power with an exponent of 0.</p> <p>6. Describe the role of the negative in the exponent when simplifying <math>4^{-1}</math>.</p>	<p> <input type="checkbox"/> Very comfortable</p> <p> <input type="checkbox"/> Somewhat comfortable</p> <p> <input type="checkbox"/> Not at all comfortable</p>	<p><a href="#">Zero as an Exponent</a></p> <p><a href="#">Negative Integer Exponents</a></p>
<p>I can explain the roles of a, h, and k in <math>y = a(x - h)^2 + k</math>, using the appropriate terminology and identify the vertex and the equation of</p>	<p>7. Consider the function <math>y = -2(x + 3)^2 + 5</math>.</p> <p>a) State the vertex and axis of symmetry.  b) Describe the transformations used to transform <math>y = x^2</math> into <math>y = -2(x + 3)^2 + 5</math></p>	<p> <input type="checkbox"/> Very comfortable</p> <p> <input type="checkbox"/> Somewhat comfortable</p> <p> <input type="checkbox"/> Not at all comfortable</p>	<p><a href="#">Transformations of Parabolas</a></p>

the axis of symmetry;			
I can sketch, by hand, the graph of $y = a(x - h)^2 + k$ using transformations	8. Sketch the graph of $y = -2(x + 3)^2 + 5$	 <input type="checkbox"/> <b>Very comfortable</b>  <input type="checkbox"/> <b>Somewhat comfortable</b>  <input type="checkbox"/> <b>Not at all comfortable</b>	<a href="#">Graphing Given Vertex Form</a>
I can factor polynomial expressions involving common factors, trinomials, and differences of squares using a variety of tools and strategies	9. Factor the following: a) $x^2 - 14x + 49$ b) $25x^2 - 16$ c) $3x^2 - 14x - 5$ d) $10x^3 + 35x^2 + 15x$	 <input type="checkbox"/> <b>Very comfortable</b>  <input type="checkbox"/> <b>Somewhat comfortable</b>  <input type="checkbox"/> <b>Not at all comfortable</b>	<a href="#">Algebraic Skills</a>

<p>I can determine and describe the connection between the factors of a quadratic expression and the x-intercepts of the graph using <math>y = a(x - r)(x - s)</math></p>	<p>10. Determine the equation of the graph below.</p> 	<p>  <input type="checkbox"/> Very comfortable   <input type="checkbox"/> Somewhat comfortable   <input type="checkbox"/> Not at all comfortable </p>	<p><a href="#">Finding an Equation from a Graph</a></p>
<p>I can solve quadratic equations that have real roots</p>	<p>11. Solve the following quadratic using any method:  <math>5x^2 - 2x - 4 = 0</math></p>	<p>  <input type="checkbox"/> Very comfortable   <input type="checkbox"/> Somewhat comfortable   <input type="checkbox"/> Not at all comfortable </p>	<p><a href="#">Solving Using the Quadratic Formula</a></p>

<p>I can determine the zeros and the max/min value of a quadratic relation from its graph or from its defining equation</p>	<p>12. Determine the maximum value of <math>y = 2x^2 - 36x + 130</math></p>	<p>  <input type="checkbox"/> Very comfortable   <input type="checkbox"/> Somewhat comfortable   <input type="checkbox"/> Not at all comfortable </p>	<p><a href="#">Exploring Vertex Form</a></p> <p><a href="#">Complete the Square for Vertex Form</a></p>
<p>I can solve problems arising from a realistic situation represented by a graph or an equation of a quadratic relation, with and without the use of technology</p>	<p>13. The flight path of a firework is modeled by the relation, <math>h = -5(t - 5)^2 + 127</math>, where h is the height, in metres, of the fireworks above the ground and t is the time, in seconds, since the fireworks was fired.</p> <p>a) What was the maximum height reached by the fireworks?</p> <p>b) When did the fireworks reach its maximum height?</p> <p>c) What was the height from which the fireworks were launched?</p> <p>d) What was the height of the fireworks at 2 seconds?</p> <p>e) At what time did the empty fireworks casing reach the ground?</p>	<p>  <input type="checkbox"/> Very comfortable   <input type="checkbox"/> Somewhat comfortable   <input type="checkbox"/> Not at all comfortable </p>	<p><a href="#">Applications Involving Quadratic Relations</a></p>

<p>I can define the sine, cosine, and tangent ratios (e.g., <math>\sin A = \frac{\textit{opposite}}{\textit{hypotenuse}}</math>)</p>	<p>14) Write each of the primary trig ratios in terms of the side lengths of the below triangle:</p> 	<p>  <input type="checkbox"/> Very comfortable   <input type="checkbox"/> Somewhat comfortable   <input type="checkbox"/> Not at all comfortable </p>	<p><a href="#">Trigonometric Ratios</a> <a href="#">What Is the Tangent Ratio?</a></p>
<p>I can determine the measures of the sides and angles in right triangles using the primary trigonometric ratios</p>	<p>15) Determine the measures of side AB and angle A if the length of AC is 5 and CB is 12, using primary trig ratios.</p> 	<p>  <input type="checkbox"/> Very comfortable   <input type="checkbox"/> Somewhat comfortable   <input type="checkbox"/> Not at all comfortable </p>	<p><a href="#">Applications of the Tangent Ratio</a> <a href="#">The Pythagorean Theorem</a></p>
<p>I can solve problems involving the measures of sides and angles in right triangles in real-life applications.</p>	<p>16) A surveyor is 40m from the edge of a building. The angle of elevation from the surveyor to the top of the building is <math>55^\circ</math>. What is the height of the building?</p>	<p>  <input type="checkbox"/> Very comfortable   <input type="checkbox"/> Somewhat comfortable   <input type="checkbox"/> Not at all comfortable </p>	<p><a href="#">Applications of the Tangent Ratio</a> <a href="#">Applications of Sine and Cosine</a></p>

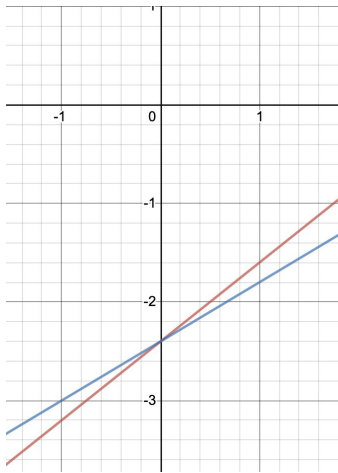
<p>I can determine the measures of sides and angles in acute triangles, using the cosine law or sine law.</p>	<p>17) Determine the measure of the unknown side YZ.</p> 	<p>  <input type="checkbox"/> Very comfortable   <input type="checkbox"/> Somewhat comfortable   <input type="checkbox"/> Not at all comfortable </p>	<p><a href="#">The Cosine Law</a> <a href="#">The Sine Law</a></p>
<p>I can solve problems involving the measures of sides and angles in acute triangles</p>	<p>18) The length of the base of an isosceles triangle is 30 metres. The angle opposite the base measures <math>32^\circ</math>. Find the perimeter of the triangle, the nearest metre.</p>	<p>  <input type="checkbox"/> Very comfortable   <input type="checkbox"/> Somewhat comfortable   <input type="checkbox"/> Not at all comfortable </p>	<p><a href="#">Applications with Acute Triangles</a></p>

## Solutions to Sample Questions:

1. Solve the system of equations.

$$4x - 5y = 12$$

$$6x - 10y = 24$$



**P.O.I at (0, -2.4)**

2. Some high school students held a bake sale recently to raise money for a field trip. They charged \$7 for fruit pies and \$10 for meat pies. They sold a total of 52 pies and earned \$424. How many of each type of pie did they sell?

**Let F represent the number of Fruit Pies sold.**

**Let M represent the number of Meat Pies sold.**

$$7F + 10M = 424 \quad (1)$$

$$F + M = 52 \quad (2)$$

**Solve (2) for F:**  $F = 52 - M$

**Sub this into (1)**

$$7(52 - M) + 10M = 424$$

$$364 - 7M + 10M = 424$$

$$3M = 60$$

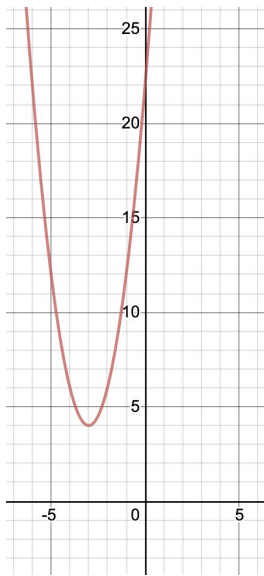
$$M = 20$$

**Sub  $M = 20$  into (2):**  $F + 20 = 52 \rightarrow F = 32$

**Therefore they sold 32 Fruit pies and 20 Meat pies**



3. For the quadratic relation  $y = 2(x + 3)^2 + 4$ , state the:
- direction of the opening; **Up**
  - stretch or compression factor; **Vertical stretch factor of 2**
  - coordinates of the vertex; **(-3,4)**
  - equation of the axis of symmetry;  $x = -3$
  - y-intercept. **22**
  - Graph the Relation



4. Evaluate:

a.  $5^0 = 1$

b.  $4^{-2} = \frac{1}{16}$

5. Describe the significance of any power with an exponent of 0. **The value will always be 1.**

6. Describe the role of the negative in the exponent when simplifying  $4^{-1}$ . **The base in this question is**  $\frac{4}{1}$

**The operation using the negative in the exponent results in the reciprocal of the base:**  $\frac{1}{4}$

7. Consider the function  $y = -2(x + 3)^2 + 5$ .

a. State the vertex and axis of symmetry. **Vertex (-3,5). Axis of symmetry:  $x = -3$**

b. Describe the transformations used to transform  $y = x^2$  into  $y = -2(x + 3)^2 + 5$

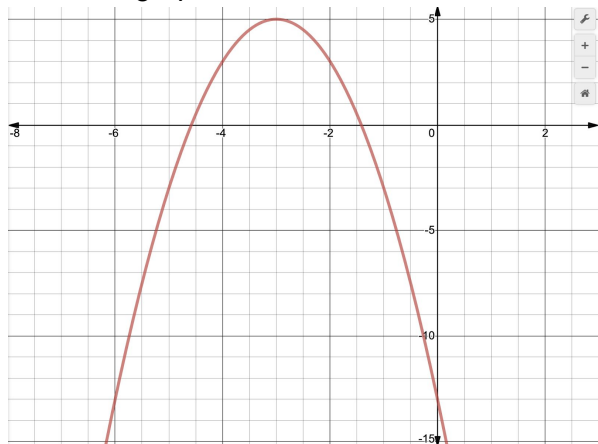
**Reflection over x-axis**

**Vertical stretch by factor of 2**

**Horizontal translation by 3 to the left**

**Vertical translation by 5 up**

8. Sketch the graph of  $y = -2(x + 3)^2 + 5$ .



9. Factor the following:

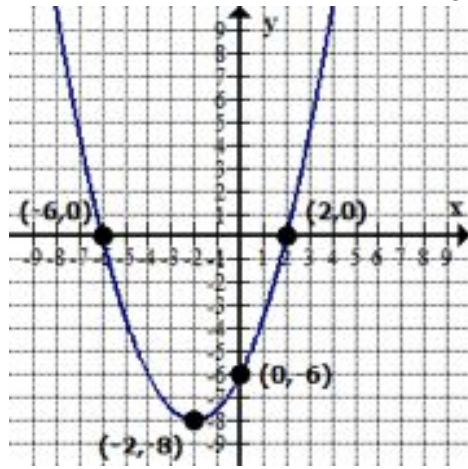
a)  $x^2 - 14x + 49 = (x - 7)(x - 7) = (x - 7)^2$

b)  $25x^2 - 16 = (5x - 4)(5x + 4)$

c)  $3x^2 - 14x - 5 = (3x + 1)(x - 5)$

$$d) 10x^3 + 35x^2 + 15x = 5x(2x^2 + 7x + 3) = 5x(2x + 1)(x + 3)$$

10. Determine the equation of the graph below.



$$y = 0.5(x + 2)^2 - 8$$

$$y = 0.5(x + 6)(x - 2)$$

11. Solve using any method

$$5x^2 - 2x - 4 = 0$$

$$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$

$$x = \frac{-5 \pm \sqrt{(-2)^2 - 4(5)(-4)}}{2(5)}$$

$$x = \frac{-5 \pm \sqrt{84}}{10}$$

$$x = -0.72, 1.11$$

12. Determine the maximum value of  $y = 2x^2 - 36x + 130$

$$y = 2x^2 - 36x + 130 = 2(x - 13)(x - 5)$$

**Axis of symmetry:**  $x = 9$

**Find the value of the function at  $x = 9$  to yield max value (as vertex must be on the axis of symmetry)**

$$y = 2(9 - 13)(9 - 5)$$

$$= 2(-4)(4)$$

$$= -32$$

13. The flight path of a firework is modeled by the relation,  $h = -5(t - 5)^2 + 127$ , where  $h$  is the height, in metres, of the fireworks above the ground and  $t$  is the time, in seconds, since the fireworks was fired.

a. What was the maximum height reached by the fireworks? **Max height of 127 metres**

b. When did the fireworks reach its maximum height? **at a time of 5 seconds.**

c. What was the height from which the fireworks were launched? **Solve when  $t = 0$ .**

$$h = -5(0 - 5)^2 + 127$$

$$= -125 + 127$$

$$= 2 \text{ m}$$

d. What was the height of the fireworks at 2 seconds? **Solve when  $t = 2$ .**

$$h = -5(3 - 5)^2 + 127$$

$$= -20 + 127$$

$$= 107$$

**Therefore the height of the fireworks was 107 m**

e. At what time did the empty fireworks casing reach the ground?

**Solve the equation**

$$0 = -5(t - 5)^2 + 127$$

$$-127 = -5(t - 5)^2$$

$$\frac{127}{5} = (t - 5)^2$$

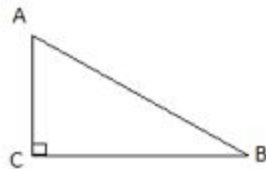
$$t - 5 = \pm \sqrt{\frac{127}{5}}$$

$$t = 5 + \sqrt{\frac{127}{5}}, 5 - \sqrt{\frac{127}{5}}$$

$$t = 10, 0$$

**Therefore the casing hit the ground at 10 seconds.**

14. Write each of the primary trig ratios, relative to A, in terms of the side lengths of the below triangle:



$$\sin A = \frac{BC}{AB} = \frac{a}{c}$$

$$\cos A = \frac{AC}{AB} = \frac{b}{c}$$

$$\tan A = \frac{BC}{AC} = \frac{a}{b}$$

15. Determine the measures of side AB and angle A if the length of AC is 5 and CB is 12, using primary trig ratios.



$$\tan A = \frac{12}{5}$$

$$A = \tan^{-1} \frac{12}{5} = 67.4^\circ$$

$$AB^2 = 5^2 + 12^2 = 25 + 144 = 169$$

$$AB = 13$$

**Or**

$$\sin 67.4 = \frac{12}{AB}$$

$$AB = \frac{12}{\sin 67.4}$$

$$AB = 13$$

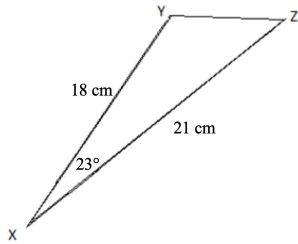
16. A surveyor is 40m from the edge of a building. The angle of elevation from the surveyor to the top of the building is  $55^\circ$ . What is the height of the building?

$$\tan 55 = \frac{\text{height}}{40}$$

$$\text{Height} = 40 \tan 55$$

$$= 57.13$$

17. Determine the measures of the unknown side YZ.

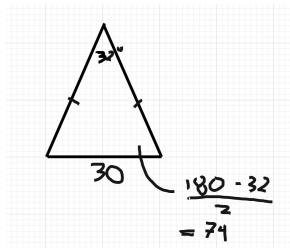


$$a^2 = b^2 + c^2 - 2 \cdot b \cdot c \cdot \cos A$$

$$a^2 = 18^2 + 21^2 - 2(18)(21)\cos 23$$

$$a = 8.31$$

18. The length of the base of an isosceles triangle is 30 metres. The angle opposite the base measures  $32^\circ$ . Find the perimeter of the triangle, the nearest metre.



Solve for the length of the two equal sides:

$$\frac{a}{\sin A} = \frac{b}{\sin B}$$

$$\frac{30}{\sin 32} = \frac{x}{\sin 74}$$

$$x = \frac{30 \sin 74}{\sin 32}$$

$$x = 54.4$$

**Perimeter** =  $30 + 2(54.4) = 138.8$

**Therefore the perimeter to the nearest metre is 139m.**