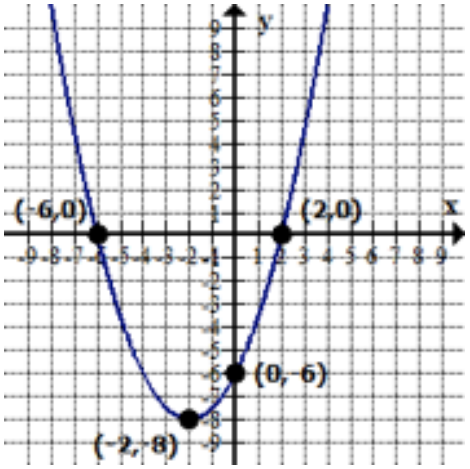
Self-Assessment for Grade 11 University Math (MCR3U)

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).

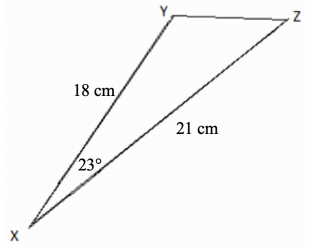
The questions in this self-assessment reflect some of the key ideas learned in prerequisite courses. They do not represent the problem solving approach or the rich experience that students would be exposed to in a classroom. The intention is for students to revisit some key concepts and, if needed, access 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?	 ☐ **Very comfortable**  ☐ **Somewhat comfortable**  ☐ **Not at all comfortable**	Solve Systems of Linear Equations
I can identify the key features of a graph of a parabola and use the appropriate terminology to describe them	3. For the quadratic relation $y = 2(x+3)^2 + 4$, state the: 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	 ☐ **Very comfortable**  ☐ **Somewhat comfortable**  ☐ **Not at all comfortable**	Key Features of a Parabola

I can determine the meaning of a negative exponent and of zero as an exponent	4. Evaluate: a) 5^0 b) 4^{-2} 5. Describe the significance of any power with an exponent of 0. 6. Describe the role of the negative in the exponent when simplifying 4^{-1}.	 ☐ **Very comfortable**  ☐ **Somewhat comfortable**  ☐ **Not at all comfortable**	Zero as an Exponent Negative Integer Exponents
I can explain the roles of a, h, and k in $y = a(x - h)^2 + k$, using the appropriate terminology and identify the vertex and the equation of the axis of symmetry;	7. Consider the function $y = -2(x+3)^2+5$. a) State the vertex and axis of symmetry. b) Describe the transformations used to transform $y = x^2$ into $y = -2(x+3)^2+5$	 ☐ **Very comfortable**  ☐ **Somewhat comfortable**  ☐ **Not at all comfortable**	Transformations of Parabolas
I can sketch, by hand, the graph of $y = a(x - h)^2 + k$ using transformations	8. Sketch the graph of $y = -2(x+3)^2+5$	 ☐ **Very comfortable**  ☐ **Somewhat comfortable**  ☐ **Not at all comfortable**	Graphing Given Vertex Form

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) $10x^3 + 35x^2 + 15x$	 ☐ **Very comfortable**  ☐ **Somewhat comfortable**  ☐ **Not at all comfortable**	Algebraic Skills
I can determine and describe the connection between the factors of a quadratic expression and the x-intercepts of the graph using $y = a(x - r)(x - s)$	10. Determine the equation of the graph below. 	 ☐ **Very comfortable**  ☐ **Somewhat comfortable**  ☐ **Not at all comfortable**	Finding an Equation from a Graph
I can solve quadratic equations that have real roots	11. Solve the following quadratic using any method: $5x^2 - 2x - 4 = 0$	 ☐ **Very comfortable**  ☐ **Somewhat comfortable**  ☐ **Not at all comfortable**	Solving Using the Quadratic Formula

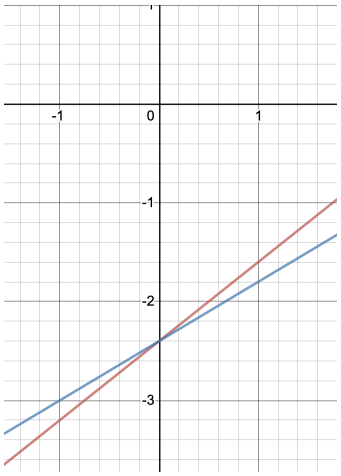
I can determine the zeros and the max/min value of a quadratic relation from its graph or from its defining equation	12. Determine the maximum value of $y = 2x^2 - 36x + 130$	☐ **Very comfortable** ☐ **Somewhat comfortable** ☐ **Not at all comfortable**	Exploring Vertex Form Complete the Square for Vertex Form
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	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? b) When did the fireworks reach its maximum height? c) What was the height from which the fireworks were launched? d) What was the height of the fireworks at 2 seconds? e) At what time did the empty fireworks casing reach the ground?	☐ **Very comfortable** ☐ **Somewhat comfortable** ☐ **Not at all comfortable**	Applications Involving Quadratic Relations
I can define the sine, cosine, and tangent ratios (e.g., $\sin A = \frac{opposite}{hypotenuse}$)	14) Write each of the primary trig ratios in terms of the side lengths of the below triangle:  	☐ **Very comfortable** ☐ **Somewhat comfortable** ☐ **Not at all comfortable**	Trigonometric Ratios What Is the Tangent Ratio?

I can determine the measures of the sides and angles in right triangles using the primary trigonometric ratios	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.  	☐ **Very comfortable** ☐ **Somewhat comfortable** ☐ **Not at all comfortable**	Applications of the Tangent Ratio The Pythagorean Theorem
I can solve problems involving the measures of sides and angles in right triangles in real-life applications.	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 $55°$. What is the height of the building?	☐ **Very comfortable** ☐ **Somewhat comfortable** ☐ **Not at all comfortable**	Applications of the Tangent Ratio Applications of Sine and Cosine
I can determine the measures of sides and angles in acute triangles, using the cosine law or sine law.	17) Determine the measure of the unknown side YZ.  	☐ **Very comfortable** ☐ **Somewhat comfortable** ☐ **Not at all comfortable**	The Cosine Law The Sine Law
I can solve problems involving the measures of sides and angles in acute triangles	18) The length of the base of an isosceles triangle is 30 metres. The angle opposite the base measures $32°$. Find the perimeter of the triangle, the nearest metre.	☐ **Very comfortable** ☐ **Somewhat comfortable** ☐ **Not at all comfortable**	Applications with Acute Triangles

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.

$7F + 10M = 424$ **(1)**

$F + M = 52$ **(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:

a. direction of the opening; **Up**

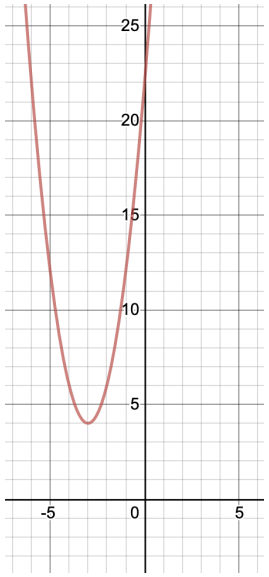
b. stretch or compression factor; **Vertical stretch factor of 2**

c. coordinates of the vertex; **(-3,4)**

d. equation of the axis of symmetry; $x = -3$

e. y-intercept. **22**

f. 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: $\frac{1}{4}$

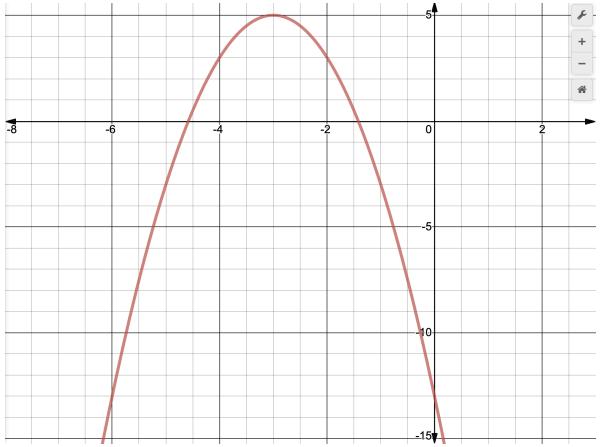
7. Consider the function $y = -2(x+3)^2+5$.

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

b. 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:

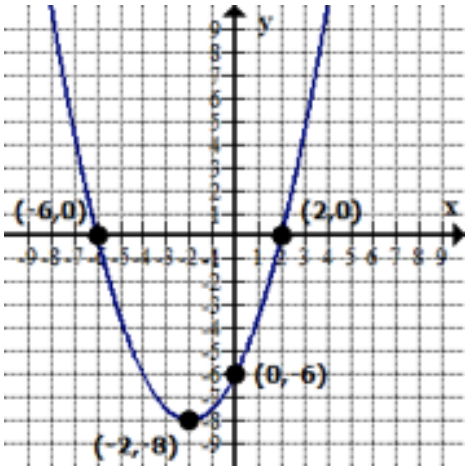
a) $x^2-14x+49=(x-7)(x-7)=(x-7)^2$

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

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

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

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

$$x = \frac{2 \pm \sqrt{84}}{10}$$

$$x = -0.72, 1.12$$

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.**

$$h = -5(0-5)^2 + 127$$
$$= -125 + 127$$
$$= 2\,m$$

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

$$h = -5(2-5)^2 + 127$$
$$= -45 + 127$$
$$= 82$$

Therefore the height of the fireworks was 82 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.

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

$$A = Tan^{-1}\frac{12}{5} = 67.4°$$

$$AB^2 = 5^2 + 12^2 = 25 + 144 = 169$$
$$AB = 13$$

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°. What is the height of the

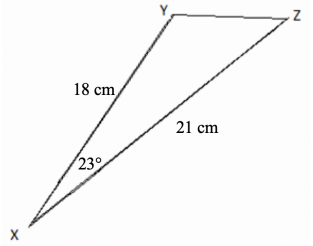
building?

$$Tan\ 55 = \frac{height}{40}$$

$$Height = 40\ Tan\ 55$$

$$= 57.13$$

17. Determine the measures of the unknown side YZ.

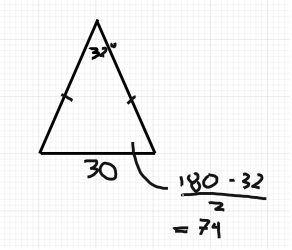


$$a^2 = b^2 + c^2 - 2 \cdot b \cdot c \cdot \cos A$$

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

$$a = 8.31$$

18. The length of the base of an isosceles triangle is 30 metres. The angle opposite the base measures 32°. 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.