# MCR3U Practice Exam

**Based on Chapter 2-6 Unit Tests**

**Time:** 2 Hours

## Instructions

1. Make sure all pages are present.
2. Non-graphing calculators are permitted.
3. Exact values are required except where indicated.
4. Show all your work clearly.

---

## PART A: Answer in space provided. Only the answer is needed.

1. **Evaluate:** If $f(x) = -3(x+4)^2 + 27$, determine the value of the maximum or minimum.

*(From Ch3 Q3)*

2. For the quadratic function $f(x) = -3(x+4)^2 + 27$, state:

- (a) The vertex
- (b) The axis of symmetry
- © The $y$-intercept
- (d) The $x$-intercepts

*(From Ch3 Q3)*

3. For the exponential function $y = 2\left(3^{-\frac{1}{2}(x-2)}\right) - 4$:

- (a) State the base (parent) function
- (b) State the equation of the asymptote
- © State the $y$-intercept

*(From Ch4 Q2)*

4. **Simplify** the following (State restrictions):

- (a) $\frac{x+7}{(x+7)^2}$
- (b) $\frac{x^2y^3}{yx^3}$

*(From Ch2 Q1)*

5. **Factor** the following:

- (a) $m^2 - 4m - 5$
- (b) $2x^2 + 7x + 3$
- © $9x^2 - 24x + 16$

*(From Ch2 Q2)*

6. For the sinusoidal function $f(x) = -2\cos(3x - 120) - 1$, determine:

- (a) The phase shift
- (b) The amplitude
- © The period
- (d) The axis equation
- (e) The max value

- (f) The min value

*(From Ch6 Q2)*

7. **Simplify** the radical:

- $\sqrt{108}$

*(From Ch3 Q2)*

8. For a terminal arm created by the point $P(-3, -6)$:

- (a) Determine the exact value of $r$
- (b) State the exact values of $\sin\theta$, $\cos\theta$, $\tan\theta$
- © Determine the related acute angle $\alpha$ (to 1 decimal place)

*(From Ch5 Q5)*

9. Determine the exact value of $\sec(210^\circ)$.

*(From Ch5 Q6)*

10. **Simplify** with positive exponents:

- (a) $\left(\frac{3x^2}{y^{-3}}\right)^{-5}$
- (b) $\left[\left(2x^2\right)^{-2}\right]^{-3}$

*(From Ch4 Q1)*

---

# PART B: Provide complete solutions.

---

**Clearly indicate your final answer.**

1. **Simplify** and state all restrictions:

$$\frac{2x^2+5x+2}{2x^2+7x+3} \div \frac{2x^2+x-6}{x^2-2x-15}$$

*(From Ch2 Q3)*

2. **Solve** the following quadratic equations (Factoring is preferred if possible):

- (a) $2x^2 - 9x - 5 = 0$
- (b) $2x^2 + 2.7x - 5.1 = 0$

*(From Ch3 Q1)*

3. **Simplify** the following exact value expression:

$$(7\sqrt{2} + \sqrt{3})(7\sqrt{2} - \sqrt{3})$$

*(From Ch3 Q2)*

4. **Application (Quadratic):**

Firas and Ron are playing baseball. Firas pitches the ball to Ron and Ron hits the ball. $t$ seconds after the ball is hit, its height in meters is given by $h(t) = -5t^2 + 20t + 0.8$.

- (a) How high was the ball above the ground when it was hit?
- (b) What is the maximum height of the ball?
- © When will the ball hit the ground?

*(From Ch3 Q4)*

5. **Application (Trigonometry):**

in $\Delta ABC$ sides $a = 26$ cm, $b = 63$ cm, and $c = 44$ cm. Determine all angles to 1 decimal place.

*(From Ch5 Q2)*

6. **Trigonometric Equations:**

For $\cos(A) = -\frac{2}{3}$, where $0^\circ \leq A \leq 360^\circ$:

- (a) Sketch the possible positions of the terminal arms for angle $A$ on the Cartesian plane.
- (b) Determine the exact values of $\tan(A)$.
- © Determine all values for $A$ to 1 decimal place.

*(From Ch5 Q7)*

7. **Graphing (Exponential):**

For the function $y = 2\left(3^{-\frac{1}{2}(x-2)}\right) - 4$:

- Graph and label the function.
- Identify at least 2 key points and the asymptote on the graph.
- Show and use pointwise formula.

*(From Ch4 Q3)*

8. **Application (Sinusoidal):**

The diameter of a car's tire is 60 cm. While the car is being driven, the tire picks up a nail.

- (a) Draw a graph and write a trig function that describes the height of the nail above the ground as a function of the distance the car has traveled after picking up the nail.
- (b) How high above the ground is the nail after the car has traveled 1.2 km?

*(From Ch6 Q6)*