

MCR3U: Functions & Transformations Worksheet

Ontario Curriculum • Grade 11 University Preparation Mathematics

Student Name: _____

Date: _____

Summary: General Transformation Model & Mapping Rule

$$y = a \cdot f(k(x - d)) + c \implies \text{Mapping Rule: } (x, y) \rightarrow \left(\frac{x}{k} + d, ay + c\right)$$

- **Vertical:** $|a| > 1$ stretch, $0 < |a| < 1$ compression; if $a < 0$, reflect in x-axis; c = shift up/down.
- **Horizontal:** $|k| > 1$ compress, $0 < |k| < 1$ stretch (factor $1/|k|$); if $k < 0$, reflect in y-axis; d = shift right/left.

PART A: Identifying Transformations & Mapping Rules

1. Given: $g(x) = -3\sqrt{x + 4} - 5$

a) Parent Function: $f(x) =$ _____

b) List of transformations in order:

1. _____
2. _____
3. _____
4. _____

c) Mapping Rule: $(x, y) \rightarrow ($ _____ , _____)

2. Given: $g(x) = \frac{1}{2}(2x - 6)^2 + 1$

a) Factored Form: $g(x) =$ _____

b) Parent Function: $f(x) =$ _____

c) List of transformations in order:

1. _____
2. _____
3. _____
4. _____

d) Mapping Rule: $(x, y) \rightarrow ($ _____ , _____)

3. Given: $g(x) = \frac{2}{-(x + 1)} - 3$

a) Parent Function: $f(x) =$ _____

b) List of transformations in order:

1. _____
2. _____
3. _____
4. _____

c) Mapping Rule: $(x, y) \rightarrow ($ _____ , _____)

PART B: Graphing Functions Using Mapping & Transformations

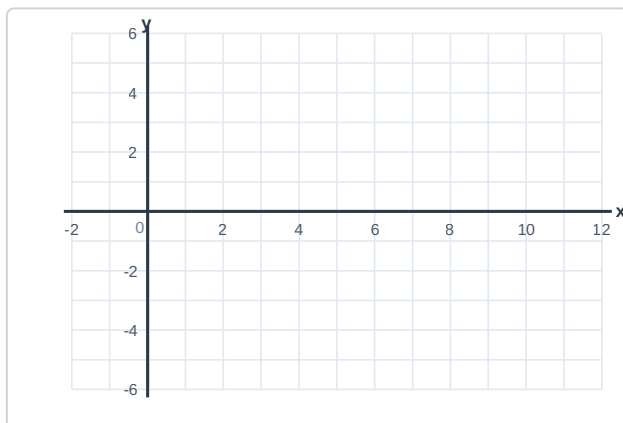
4. Radical Function: Graph $g(x) = -2\sqrt{x-1} + 3$

- Mapping Rule: $(x, y) \rightarrow (\quad , \quad)$

Base Points: $f(x) = \sqrt{x}$	Transformed Points: $g(x)$
(0, 0)	(,)
(1, 1)	(,)
(4, 2)	(,)
(9, 3)	(,)

Domain: $\{ x \in \mathbb{R} \mid \quad \}$

Range: $\{ y \in \mathbb{R} \mid \quad \}$



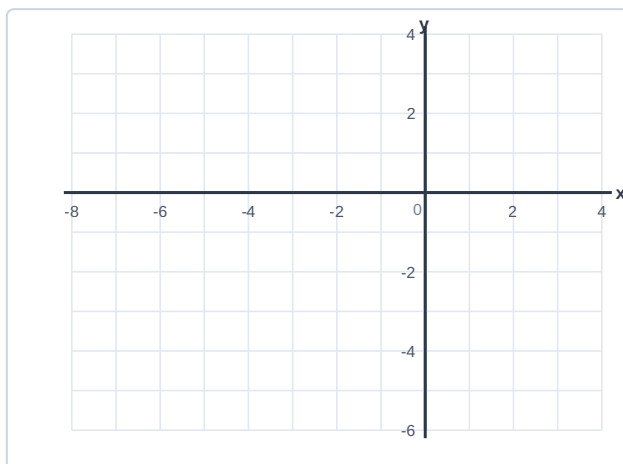
5. Reciprocal Function: Graph $g(x) = \frac{1}{(x+3)} - 2$

- Mapping Rule: $(x, y) \rightarrow (\quad , \quad)$
- Vertical Asymptote: $x = \quad$ • Horizontal Asymptote: $y = \quad$

Base Points: $f(x) = \frac{1}{x}$	Transformed Points: $g(x)$
(-2, -0.5)	(,)
(-1, -1)	(,)
(-0.5, -2)	(,)
(0.5, 2)	(,)
(1, 1)	(,)
(2, 0.5)	(,)

Domain: $\{ x \in \mathbb{R} \mid \quad \}$

Range: $\{ y \in \mathbb{R} \mid \quad \}$



PART C: Applications & Algebraic Reasoning

6. Determining an Equation from Verbal Descriptions

The quadratic base function $f(x) = x^2$ undergoes the following sequential transformations:

1. Reflected in the x-axis
2. Vertically compressed by a factor of $\frac{1}{4}$
3. Horizontally compressed by a factor of $\frac{1}{3}$
4. Translated 5 units left and 7 units up

Show intermediate steps and identify parameters (a , k , d , c):

Final Equation: $g(x) =$ _____

7. Image Point Coordinate Transformation

The point $(4, -6)$ lies on the graph of $y = f(x)$.

Determine the exact coordinates of its corresponding image point on the transformed function:

$$y = -3 f\left(\frac{1}{2}x + 2\right) - 1$$

Show full step-by-step algebraic solution:

Step 1 (Factor inside argument):

Step 2 (State mapping rule):

Step 3 (Substitute coordinates):

Final Transformed Coordinates: (_____ , _____)