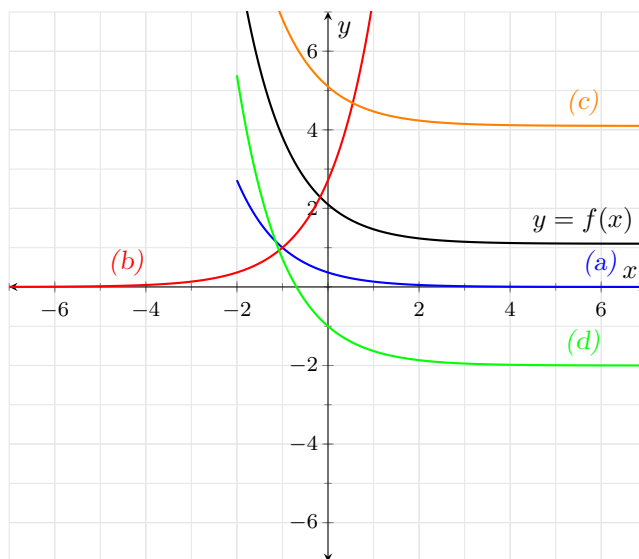


Part 1

Function Transformations

FT1.tex

Exercise 1 If the graph of $y = f(x)$ is given in black below, which of the following graphs could be the graph of $y = f(x) + 3$?

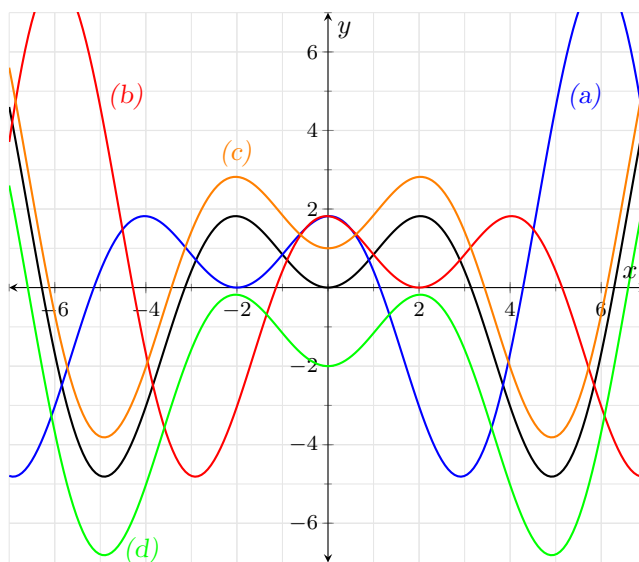


Multiple Choice:

- (a) Blue graph
- (b) Red graph
- (c) Orange graph ✓
- (d) Green graph

FT2.tex

Exercise 2 If the graph of $y = f(x) = x \sin(x)$ is given in black below (namely, the only one below with $f(0) = 0$), which of the following graphs could be the graph of $y = f(x - 2)$?



Multiple Choice:

- (a) Blue graph
- (b) Red graph ✓
- (c) Orange graph
- (d) Green graph

FT3.tex

Exercise 3 Write the quadratic function $f(x) = 4x^2 + 44x + 33$ in vertex-form, by completing the squares:

$$f(x) = \boxed{4} \left(x - \boxed{-\frac{11}{2}} \right)^2 + \boxed{-88}.$$

The coordinates of the vertex are:

$$(h, k) = \left(\boxed{-\frac{11}{2}}, \boxed{-88} \right).$$

FT4.tex

Exercise 4 Write the quadratic function $f(x) = -2x^2 + 10x + 13$ in vertex-form, by completing the squares:

$$f(x) = \boxed{-2} \left(x - \boxed{\frac{5}{2}} \right)^2 + \boxed{\frac{51}{2}}.$$

The coordinates of the vertex are:

$$(h, k) = \left(\boxed{\frac{5}{2}}, \boxed{\frac{51}{2}} \right).$$

FT5.tex

Transform the given function by a vertical stretch with a factor of 2.

$$f(x) = x^3 - 4x$$

Exercise 5 Which of the following represents a vertical stretch by a factor of 2?

Multiple Choice:

- (a) $2f(x)$ ✓
- (b) $f(2x)$

Exercise 6 What is the equation of the transformed function?

$$2f(x) = \boxed{2x^3 - 8x}$$

FT6.tex

Transform the given function by compressing it horizontally by a factor of 3.

$$f(x) = x^2 + x - 2$$

Exercise 7 Which of the following represents a horizontal compression by a factor of 3?

Multiple Choice:

- (a) $\frac{1}{3}f(x)$
- (b) $f(3x)$ ✓
- (c) $f(\frac{x}{3})$

Exercise 8 What is the equation of the transformed function?

$$f(3x) = \boxed{9x^2 + 3x - 2}$$

FT7.tex

Transform the given function by a vertical compression with a factor of 3.

$$f(x) = \frac{1}{x+2}$$

Exercise 9 Which of the following represents a vertical compression by a factor of 3?

Multiple Choice:

- (a) $\frac{1}{3}f(x)$ ✓
- (b) $f(3x)$
- (c) $f(\frac{x}{3})$

Exercise 10 What is the equation of the transformed function?

$$f(3x) = \boxed{\frac{1}{3x+6}}$$

FT8.tex

Transform the given function by a horizontal stretch with a factor of 2.

$$f(x) = x^3 + 2x^2 - 4x + 8$$

Exercise 11 Which of the following represents a horizontal stretch by a factor of 2?

Multiple Choice:

- (a) $2f(x)$
- (b) $f(2x)$
- (c) $f(\frac{x}{2})$ ✓

Exercise 12 What is the equation of the transformed function?

$$f(\frac{x}{2}) = \boxed{\frac{1}{8}x^3 + \frac{1}{2}x^2 - 2x + 8}$$

FT9.tex

Describe how to transform the graph of f into the graph of g

$$f(x) = (x - 1)^2 \text{ and } g(x) = -(x + 3)^2$$

Exercise 13 What type of shift occurs?

Multiple Choice:

- (a) horizontal shift to the right
- (b) horizontal shift to the left ✓
- (c) vertical shift up
- (d) vertical shift down
- (e) no shift

Exercise 14 How much of horizontal shift to the left?

units

Exercise 15 What type of stretch or shrink occurs?

Multiple Choice:

- (a) *horizontal shrink*
 - (b) *horizontal stretch*
 - (c) *vertical stretch*
 - (d) *vertical shrink*
 - (e) *no shrink or stretch* ✓
-

Exercise 16 What type of reflection occurs?

Multiple Choice:

- (a) *reflection across the x axis* ✓
 - (b) *reflection across the y axis*
 - (c) *no reflection*
-

FT10.tex

Describe how to transform the graph of f into the graph of g

$$f(x) = (x + 2)^3 \text{ and } g(x) = -(x - 1)^3$$

Exercise 17 What type of shift occurs?

Multiple Choice:

- (a) *horizontal shift to the right* ✓
 - (b) *horizontal shift to the left*
 - (c) *vertical shift up*
 - (d) *vertical shift down*
 - (e) *no shift*
-

Exercise 18 How much of horizontal shift to the right?

units

Exercise 19 What type of stretch or shrink occurs?

Multiple Choice:

- (a) horizontal shrink
- (b) horizontal stretch
- (c) vertical stretch
- (d) vertical shrink
- (e) no shrink or stretch ✓

Exercise 20 What type of reflection occurs?

Multiple Choice:

- (a) reflection across the x axis ✓
- (b) reflection across the y axis
- (c) no reflection

FT11.tex

Exercise 21 Find the equation of the reflection of f across the x axis and the y axis.

$$f(x) = x^3 - 5x^2 - 3x + 2$$

Reflection across the x -axis: $g(x) =$

Reflection across the y -axis: $g(x) =$

FT12.tex

Exercise 22 Find the equation of the reflection of f across the x axis and the y axis.

$$f(x) = 2\sqrt{x+3} - 4$$

Reflection across the x -axis: $g(x) = \boxed{-2\sqrt{x+3} + 4}$

Reflection across the y -axis: $g(x) = \boxed{2\sqrt{3-x} - 4}$

FT13.tex

Exercise 23 Let $A = f(r)$ be the area of a circle of radius r .

- Write a formula for $f(r) = \boxed{\pi r^2}$.
- Which expression represents the area of a circle whose radius is increased by 5%?

Multiple Choice:

- $f(r + 0.05)$
 - $0.05f(r)$
 - $f(r) + 0.05$
 - $f(5 + r)$
 - $f(1.05r)$ ✓
- By what percent does the area increase if the radius is increased by 5%? Round to the nearest 0.01%. Answer: $\boxed{10.25}\%$.