

## 2.6 – Transformations of Functions

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## Lesson Objectives

- ▶ Review and graph piecewise functions, step functions, and absolute-value functions
- ▶ Identify and graph transformations of functions

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## Fast Five

- ▶ Graph the following functions on separate graphs

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

$$f(x) = |x|$$

$$f(x) = \lfloor x \rfloor$$

$$f(x) = \begin{cases} \frac{1}{2}x - 2 & \text{if } -4 \leq x \leq 0 \\ -(x-2)^2 + 2 & \text{if } 0 < x \leq 4 \end{cases}$$

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## (A) Transformations $y = af(x)$

- ▶ Graph the function  $f(x) = \sqrt{4 - x^2}$
- ▶ State the domain and range of  $f(x)$
- ▶ View in a squared window
- ▶ Now graph  $y = 2f(x)$ ,  $y = 3f(x)$ ,  $y = 4f(x)$
- ▶ State the new co-ordinates of the key transformed point
- ▶ How has the original function been transformed?
- ▶ State the domain and range of the new function
- ▶ Determine the equation of  $y = f^{-1}(x)$

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(A) Transformations  $y = af(x)$ 

- ▶ Graph the function  $f(x) = \sqrt{4-x^2}$
- ▶ State the domain and range of  $f(x)$
- ▶ View in a squared window
  
- ▶ Now graph  $y = \frac{1}{2}f(x)$ ,  $y = \frac{1}{3}f(x)$ ,  $y = \frac{1}{4}f(x)$
- ▶ State the new co-ordinates of the key transformed point
- ▶ How has the original function been transformed?
- ▶ State the domain and range of the new function
  
- ▶ Determine  $f \circ f^{-1}(x)$

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(A) Transformations  $y = af(x)$ 

- ▶ Graph the function  $f(x) = \sqrt{4-x^2}$
- ▶ State the domain and range of  $f(x)$
- ▶ View in a squared window
  
- ▶ Now graph  $y = -f(x)$
- ▶ State the new co-ordinates of the key transformed point
- ▶ How has the original function been transformed?
- ▶ State the domain and range of the new function
  
- ▶ Graph  $y = \lfloor f(x) \rfloor$

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(B) Transformations  $y = f(bx)$ 

- ▶ Graph the function  $f(x) = \sqrt{4-(x)^2}$
- ▶ State the domain and range of  $f(x)$
- ▶ View in a squared window
  
- ▶ Now graph  $y = f(2x)$ ,  $y = f(3x)$ ,  $y = f(4x)$
- ▶ State the new co-ordinates of the key transformed point
- ▶ How has the original function been transformed?
- ▶ State the domain and range of the new function
  
- ▶ Graph  $y = \lfloor f^{-1}(x) \rfloor$

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(B) Transformations  $y = f(bx)$ 

- ▶ Graph the function  $f(x) = \sqrt{4-(x)^2}$
- ▶ State the domain and range of  $f(x)$
- ▶ View in a squared window
  
- ▶ Now graph  $y = f(\frac{1}{2}x)$ ,  $y = f(\frac{1}{3}x)$ ,  $y = f(\frac{1}{4}x)$
- ▶ State the new co-ordinates of the key transformed point
- ▶ How has the original function been transformed?
- ▶ State the domain and range of the new function
  
- ▶ Graph  $y = \frac{1}{f(x)}$

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(c) Transformations  $y = f(x + c)$ 

- ▶ Graph the function  $y = |x|$
- ▶ State the domain and range of  $f(x)$
- ▶ View in a squared window
  
- ▶ Now graph  $y = f(x + 2)$ ,  $y = f(x + 3)$ ,  $y = f(x + 4)$
- ▶ State the new co-ordinates of the key transformed point
- ▶ How has the original function been transformed?
- ▶ State the domain and range of the new function?
  
- ▶ If  $g(x) = x + 2$  and  $f(x) = |x|$ , determine the equation and graph  $y = f \circ g(x)$

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(c) Transformations  $y = f(x + c)$ 

- ▶ Graph the function  $y = |x|$
- ▶ State the domain and range of  $f(x)$
- ▶ View in a squared window
  
- ▶ Now graph  $y = f(x - 2)$ ,  $y = f(x - 3)$ ,  $y = f(x - 4)$
- ▶ State the new co-ordinates of the key transformed point
- ▶ How has the original function been transformed?
- ▶ State the domain and range of the new function?
  
- ▶ If  $g(x) = x - 3$  and  $f(x) = |x|$ , determine the equation and graph  $y = f \circ g(x)$

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(d) Transformations  $y = f(x) + d$ 

- ▶ Graph the function  $f(x) = \lfloor x \rfloor$
- ▶ State the domain and range of  $f(x)$
- ▶ View in a squared window
  
- ▶ Now graph  $y = f(x) + 2$ ,  $y = f(x) + 3$ ,  $y = f(x) + 4$
- ▶ State the new co-ordinates of the key transformed point
- ▶ How has the original function been transformed?
- ▶ State the domain and range of the new function?
  
- ▶ Determine the equation for  $y = f^{-1}(x)$

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(d) Transformations  $y = f(x) + d$ 

- ▶ Graph the function  $f(x) = \lfloor x \rfloor$
- ▶ State the domain and range of  $f(x)$
- ▶ View in a squared window
  
- ▶ Now graph  $y = f(x) - 2$ ,  $y = f(x) - 3$ ,  $y = f(x) - 4$
- ▶ State the new co-ordinates of the key transformed point
- ▶ How has the original function been transformed?
- ▶ State the domain and range of the new function?
  
- ▶ Determine the equation for  $y = f^{-1}(x)$

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## (e) Putting it altogether

▶ Graph the function:  $f(x) = \begin{cases} \frac{1}{2}x - 2 & \text{if } -4 \leq x \leq 0 \\ -(x-2)^2 + 2 & \text{if } 0 < x \leq 4 \end{cases}$

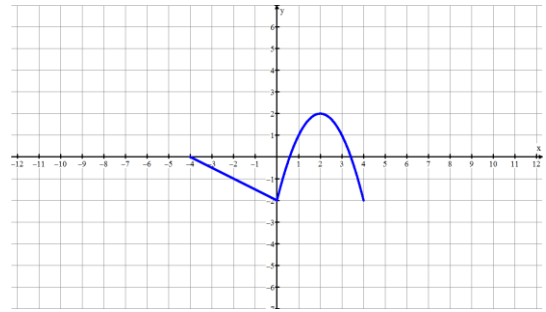
▶ Evaluate the key points at  $f(-4)$ ,  $f(0)$ ,  $f(2)$ ,  $f(-4)$

▶ Graph  $y = -\frac{1}{2}f(2x+8) - 1$

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## (e) Putting it altogether



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## (f) Homework

▶ p. 139 # 20-23, 25, 35-41 odds, 52-53, 57-58, 62-65

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