4.1 Transformations

NOTES

Pre-Calculus

Write your questions here!

PARENT FUNCTION –

TRANSLATION –

Vertical shift	Horizontal shift
Given parent function $y = x^2$ Describe translation $y = (x-3)^2 - 5$	Given parent function $f(x) = \sqrt{x}$ Write function with vertical shift up of 5 and horizontal shift left of 17

SCALE –

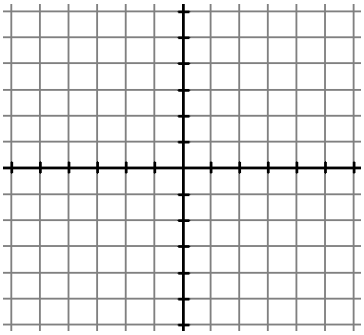
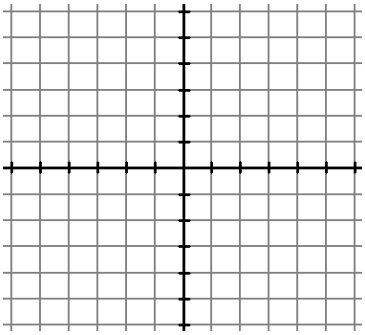
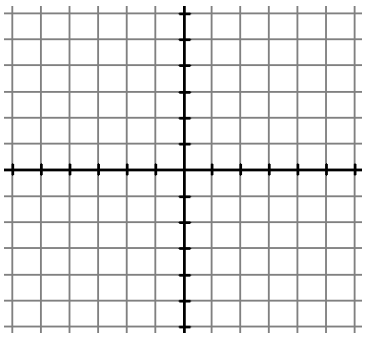
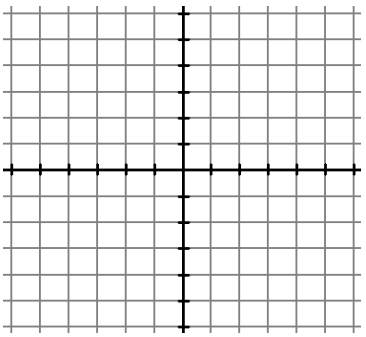
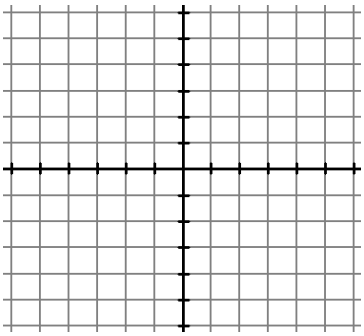
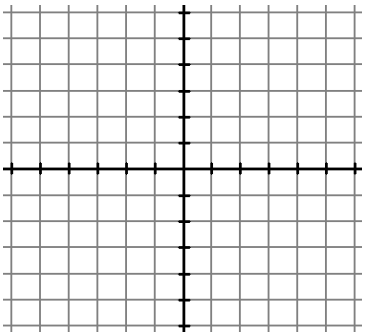
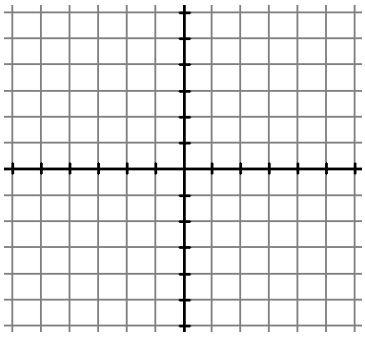
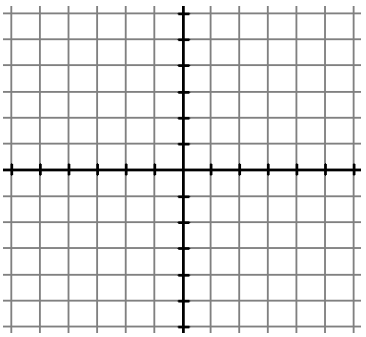
Vertical stretch/shrink	Horizontal stretch/shrink
Given parent function $y = x^2$ Describe scale $y = 4(x-3)^2 - 5$ Describe scale $y = (2x-8)^2 - 5$	Given parent function $f(x) = x^3$ Write function vertical shift down of 5 and horizontal shrink by a factor of $\frac{1}{3}$ Write function horizontal shift right of 2, vertical shift up 3, and vertical stretch by factor of 4

REFLECTIONS –

About *x*-axis	About *y*-axis
Given parent function $y = x^2$ Describe reflection $y = -4(x-3)^2 - 5$ Describe reflection $y = 2(4-x)^2 - 5$	Given parent function $f(x) = \lvert x \rvert$ Write function vertical shift up of 1 and reflected about the *x*-axis Write function horizontal shift left of 2, vertical shrink by a factor of 5, and reflected about *y*-axis

GENERAL EQUATION OF FUNCTIONS

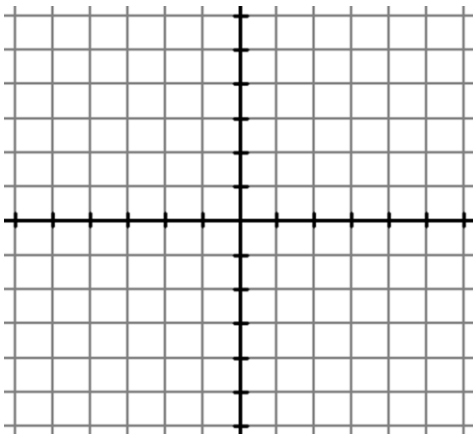
$a =$ $b =$ $h =$ $k =$

Quadratic Function $f(x) = x^2$  $y = a(x-h)^2 + k$	Cubic Function $f(x) = x^3$  $y = a(x-h)^3 + k$	Absolute Value Function $f(x) = \lvert x \rvert$  $y = a\lvert x-h \rvert + k$	Square Root Function $f(x) = \sqrt{x}$  $y = a\sqrt{x-h} + k$
Exponential Function $f(x) = 2^x$  $y = a \cdot 2^{(x-h)} + k$	Logarithmic Function $f(x) = \log x$  $y = a\log(x-h) + k$	Greatest Integer Function $f(x) = [\![x]\!]$  $y = a[\![x-h]\!] + b$	Rational Function $f(x) = \frac{1}{x}$  $y = \frac{a}{x-h} + k$

Graph the following, use a table of values to help out if necessary.

$$f(x) = -2\sqrt{x+1} - 3$$

Rules:



SUMMARY:

Now, summarize your notes here!

4.1 Transformations

PRACTICE

Name the parent function. Then describe the transformation (translation, scale, and reflection) of the function if it exists.

Translation **Vertical Shift up/down ?** **Horizontal Shift right/left ?**	**Scale** **Vertical Stretch/Shrink of ?** **Horizontal Stretch/Shrink of ?**	**Reflection** **About the *x*-axis** **About the *y*-axis**
1. $y = 2(x+1)^3$ NAME:_____ Translation: Scale: Reflection:	2. $y = -(x-11)^2 - 5$ NAME:_____ Translation: Scale: Reflection:	3. $f(x) = \|3x-6\| + 8$ NAME:_____ Translation: Scale: Reflection:
4. $f(x) = -\frac{1}{2}\sqrt{5-x}$ NAME:_____ Translation: Scale: Reflection:	5. $y = \log_2(-x) + 4$ NAME:_____ Translation: Scale: Reflection:	6. $f(x) = \frac{1}{3}e^{x-1} - 4$ NAME:_____ Translation: Scale: Reflection:
7. $y = -\frac{4}{2x+3} - 19$ NAME:_____ Translation: Scale: Reflection:	8. $f(x) = \left[\!\left[\frac{1}{4}x\right]\!\right] + 5$ NAME:_____ Translation: Scale: Reflection:	9. $y = 4 - x^3$ NAME:_____ Translation: Scale: Reflection:

Given the parent function $f(x) = |x|$, write the equation of the following transformation…

10. Vertical shift up 3 and horizontal shift right 2	11. Horizontal shift left 3, vertical stretch of 4	12. Reflect about *y*-axis, vertical shift up 2, horizontal stretch of 5

Given the parent function $f(x) = x^3$, write the equation of the following transformation…

13. Reflect about the *x*-axis, horizontal shift right 2, vertical shrink of ½	14. Horizontal shrink of $\frac{1}{4}$, vertical shift down 6	15. horizontal shift left 4, vertical shift down 7, horizontal stretch of 8

Given the parent function $f(x) = \frac{1}{x}$, write the equation of the following transformation…

16. Horizontal shift left 3, reflect about *x*-axis.

17. Vertical shift up 5

18. Vertical stretch 3, horizontal shift right 5

Given the parent function $f(x) = e^x$, write the equation of the following transformation…

19. Reflect about the *y*-axis and horizontal shift right 8

20. Horizontal shrink of ½ and reflect about the *x*-axis

21. Vertical stretch of 6, vertical shift down 3, horizontal shift right 5, reflect about *x*-axis

Given the parent function $f(x) = \log_2 x$, write the equation of the following transformation…

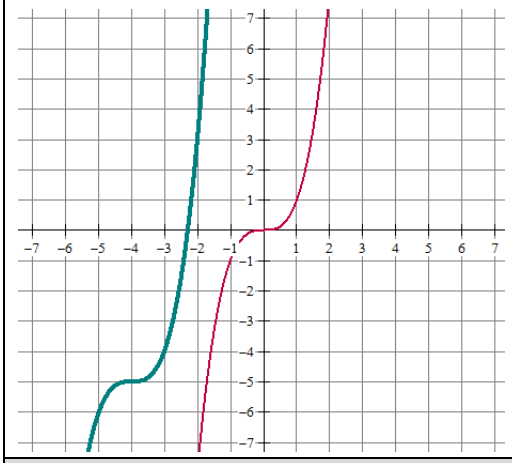
22. Horizontal shift right 3, vertical shift down 5

23. Reflect about the *x*-axis and vertical shift up 5

24. Vertical stretch of 5, reflect about the *y*-axis, horizontal stretch of 3

The graph of a parent function and a transformation of the parent function are given. Write the equation of the transformed function.

25.



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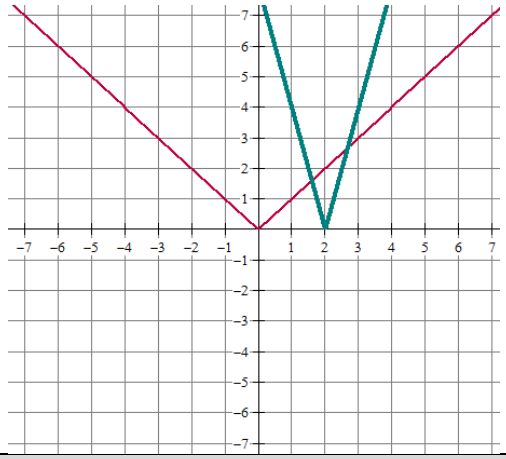

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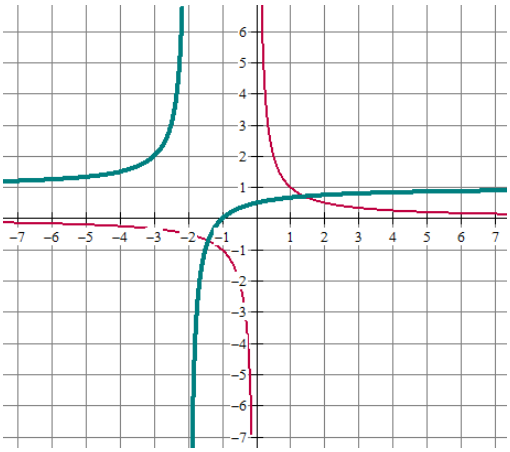
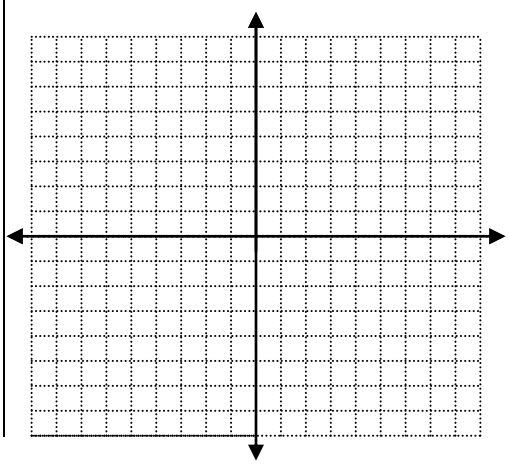
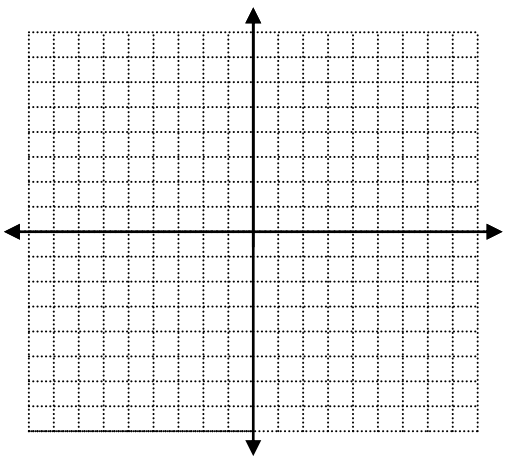


Sketch a graph of the following.

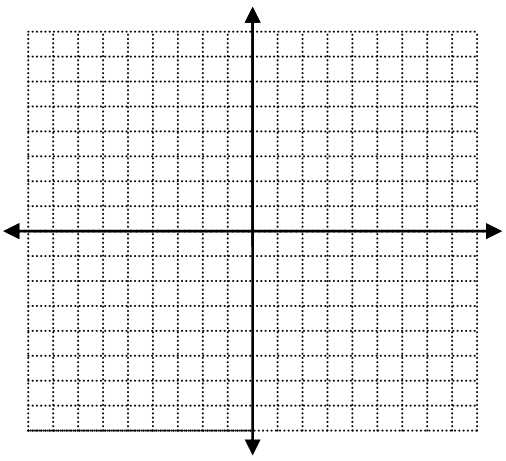
28. $y = 2(x+3)^3 - 2$



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



30. $y = [\![x - 3]\!]$



Match the function to its graph WITHOUT using a graphing calculator!

31. $y = 2\sqrt{x-3}+2$

32. $y = \sqrt{x+3}+2$

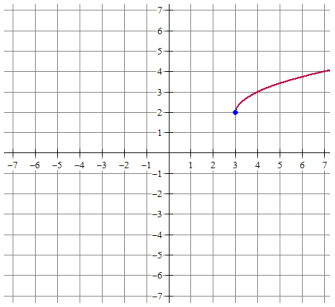
33. $y = \sqrt{3-x}+2$

34. $y = \sqrt{x-3}+2$

35. $y = -\sqrt{x+3}+2$

36. $y = 0.5\sqrt{x-3}+2$

A



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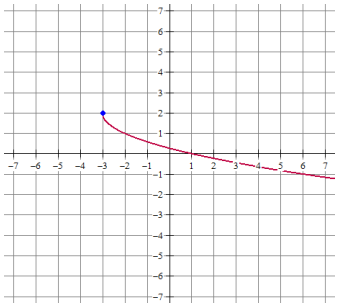

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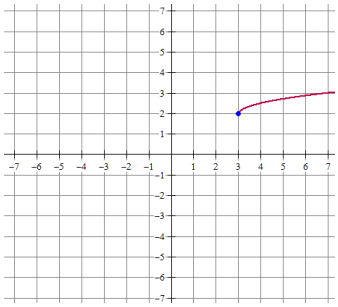

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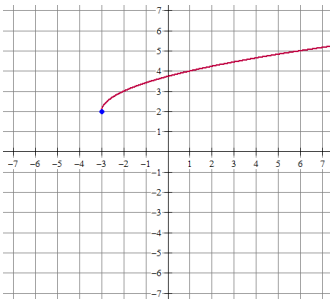

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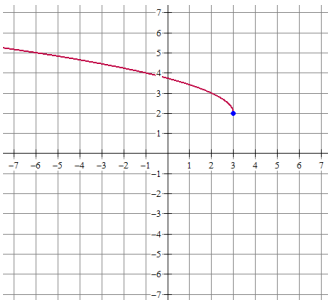
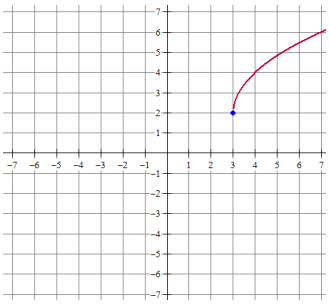


F



REVIEW SKILLS

Use the quadratic formula to solve. Express your solution(s) in exact and decimal form.

1. $11x^2 + 12x = 6$

2. $x^2 - 2x + 7 = 0$

4.1 Transformations

APPLICATION

1. $y = 2(3-x)^3$

NAME:_____

Translation:

Scale:

Reflection:

2. Given the parent function $y = [\![x]\!]$, write the equation of the following transformation.

Vertical shift up 2, horizontal shift left 3, reflect about *x*-axis

Describe the transformation (translation, scale, and/or reflection) that happens to the function $f(x)$.

3. $f(x)+2$

4. $f(x-3)$

5. $-f(x+1)-5$

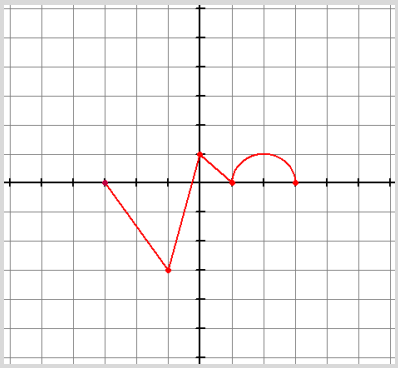
Describe the transformation (translation, scale, and/or reflection) that happens to the function $f(x)$.

6. $3f(x) + 2$

7. $f(3 - x) + 2$

8. $-5f(2x + 4) - 7$

Given the $h(x)$ is shown below:



Sketch a graph of the following:

9. $-h(x)$

10. $h(-x)$

11. $h(x) + 2$

12. $h(x + 2)$

13. $h(x - 1) + 2$

14. $-h(x + 3) - 2$

15. $2h(x)$

16. $h(2x)$

17. $\frac{1}{2}h(x)$

18. $h\left(\frac{1}{2}x\right)$

19. $-2h(x - 1) - 3$