FOUNDATIONS – Relationship Patterns, Functions, and Using a Graphing Calculator

What is Algebra?

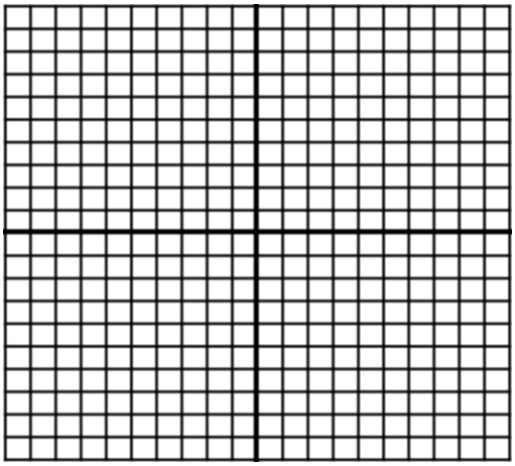
ChatGPT says (and I like it) - Algebra is a powerful tool for analyzing patterns, making predictions, and understanding the relationships between different mathematical and real-world concepts. Algebra is a fundamental part of mathematics and serves as a building block for more advanced mathematical disciplines like calculus, linear algebra, and abstract algebra.

Activity 1 – Why do we write numbers the way we do?

Activity 2 – Ticket Sales at a Fair

Ticket sales to a particular fair are $4 for children and $9 for adults. On one particular day, the fair made $513 on ticket sales.

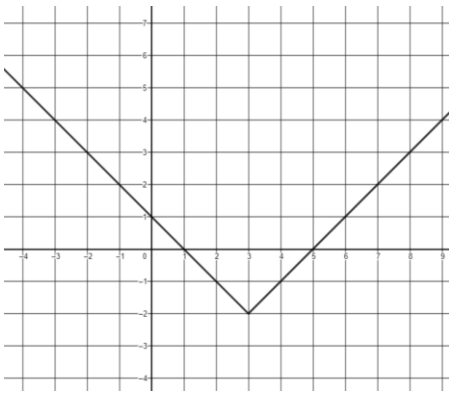
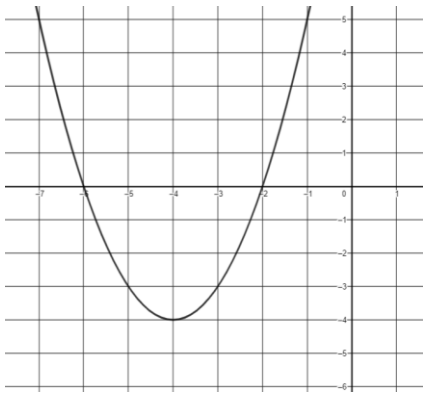
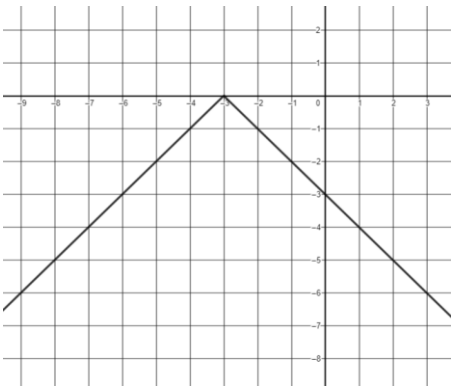
More Practice

Find four solutions for the equation $y = \frac{1}{2}x - 7$.	Ticket sales to a particular fair are \$3 for children and \$7 for adults. Find 4 different combinations of ticket sales for children and adults where the total profit is \$237.
Ticket sales to a particular fair are \$3 for children and \$7 for adults. Let x equal the number of child tickets, and let y equal the number of adult tickets. Write an equation for combinations of ticket sales if the total sales is \$237. Equation must contain the variables x and y.	Graph the linear function $y = \frac{1}{2}x - 7$. 

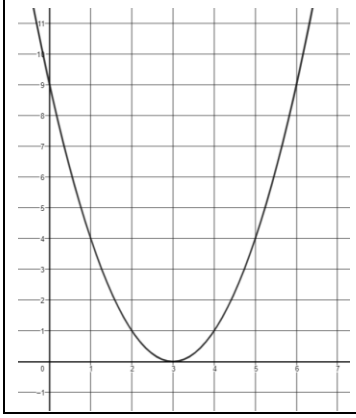
Graphing Utility Activity – Transformations Review

Transformation Notes:

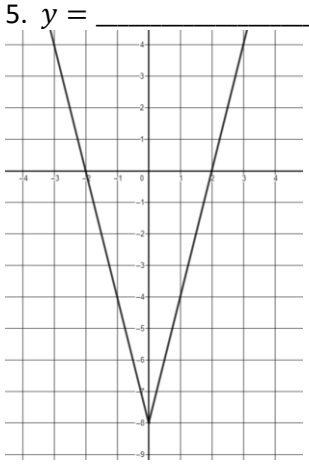
* Determine an equation for each graph by using a graphing utility to manipulate the equation $\boldsymbol{y = |x|}$ **or** $\boldsymbol{y = x^2}$**.**

1. $y =$ _____	2. $y =$ _____	3. $y =$ _____
		

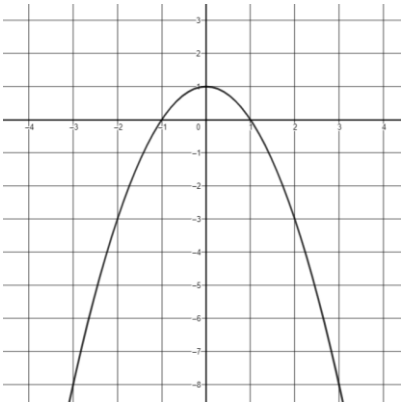
4. $y =$ _____



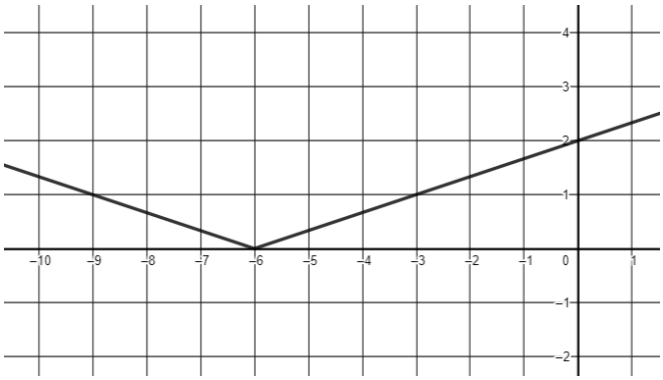
5. $y =$ _____



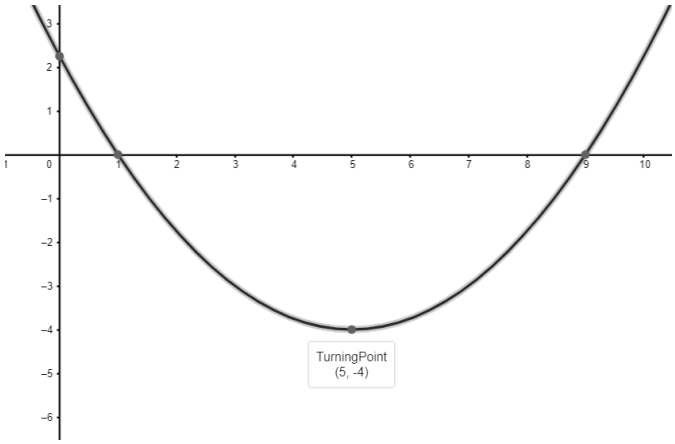
6. $y =$ _____



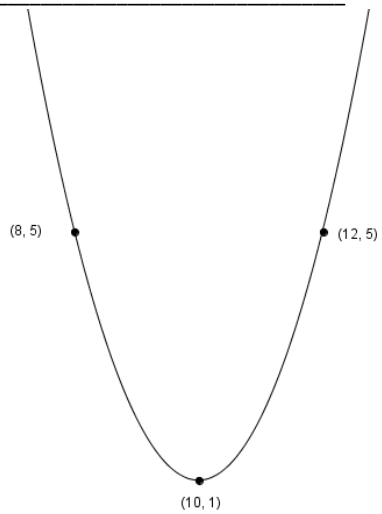
7. $y =$ _____



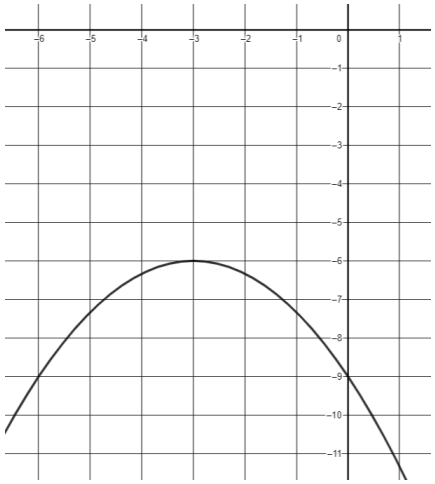
8. $y =$ _____



9. $y =$ _____



10. $y =$ _____



Algebra 2 – Enrichment

We need to look at our options and make connections about solving equations.
There is always more than one way to find solutions.

Solved Algebraically or G & C	Solved by finding Intersections	Solved by finding Zeroes
$\boldsymbol{7x + 2 = 3x + 94}$		
$\boldsymbol{\lvert 2 + 5x \rvert = 3}$		
$\boldsymbol{2x^2 - 7x = 15}$		
$\boldsymbol{4x^2 = -x + 3}$		

Solved Algebraically	Solved by finding Intersections	Solved by finding Zeroes
$\mathbf{2^x + 7 = 52}$		
$\mathbf{8(x-2)^3 + 1 = 89}$		
$\mathbf{\sqrt{x+2} = 4\sqrt{x+1}}$		
$\mathbf{\sqrt{4 - 2t - t^2} = t + 2}$		

CALCULATE MENU

- intersections
- zeros

TABLE SETUP

- starting x
- step for x-values

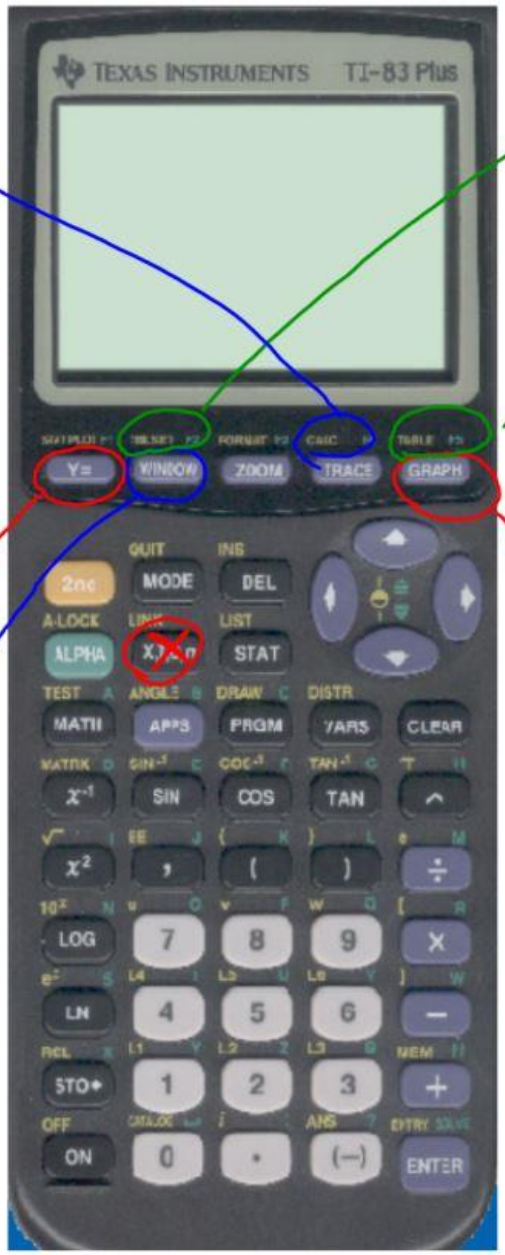
VIEW TABLE

TYPE IN FUNCTIONS

DISPLAYS GRAPH

WINDOW

- create viewing window for your graphs



Reading and Evaluating Functions

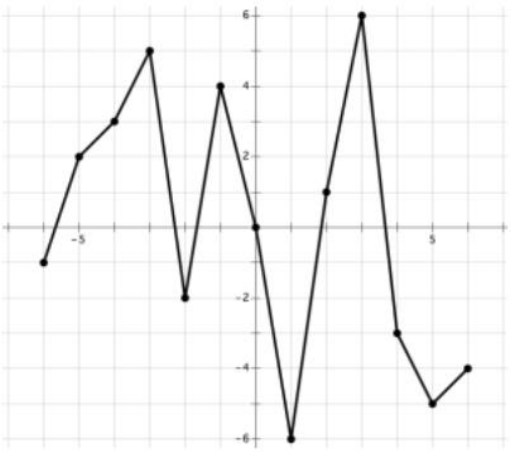
Notes:

Given functions f, g, and h, evaluate each.

$f(x) = 3x^2 - 7$

x	$g(x)$
-3	12
-2	6
-1	-4
0	2
1	-7
2	-1
3	0
4	4
5	8

$h(x)$



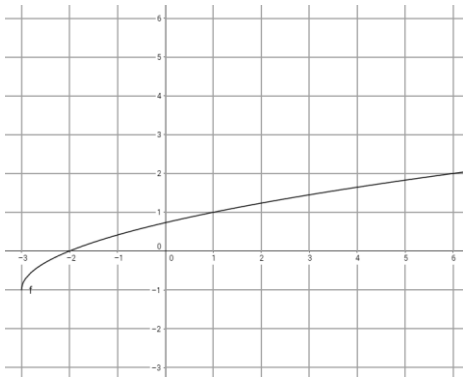
(This graph uses a scale of 1 unit)

1. $g(5) =$	2. $h(5) =$	3. $f(5) =$	4. $h(-1) =$
5. $f(2) =$	6. $h(3) =$	7. $g(-2) =$	8. $f(0) =$
9. $g(0) =$	10. $f(-2) =$	11. $h(-6) =$	12. $f(-5) =$
13. $f\big(g(2)\big) =$	14. $g\big(f(2)\big) =$	15. $h\big(g(-1)\big) =$	16. $f\big(h(-5)\big) =$
17. $g\big(g(3)\big) =$	18. $h\big(h(-4)\big) =$	19. $g \; o \; h(2) =$	20. $f \; o \; f(2) =$

Notes:

Inverses

Determine the inverse functions below and then evaluate the questions that follow.

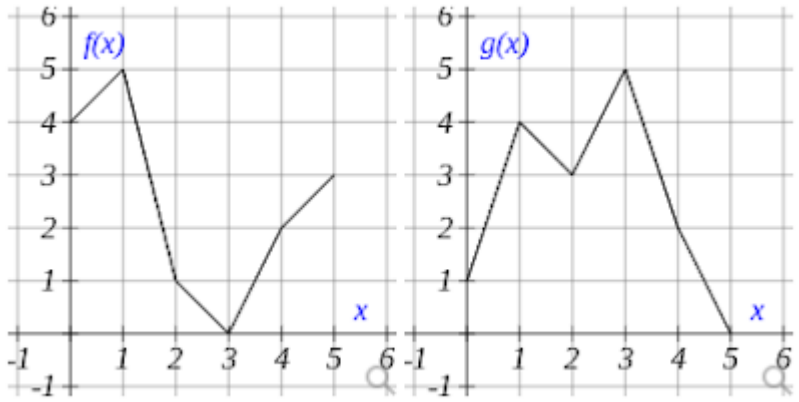
Graph the inverse of the function $f(x)$ below. Call the inverse $g(x)$.	Algebraically determine the inverse of the function $r(x)$ below. Call the inverse $s(x)$.
 (This graph uses a scale of 1 unit)	$r(x) = \sqrt{x+5}$

21. $f(-2) =$	22. $f(6) =$	23. $r(-1) =$	24. $r(4) =$
25. $g(-1) =$	26. $g(1) =$	27. $s(1) =$	28. $s(4) =$
29. $f\big(g(2)\big) =$	30. $g\big(f(-3)\big) =$	31. $r\big(s(3)\big) =$	32. $s\big(r(11)\big) =$
33. $g\big(f(12)\big) =$	34. $g\big(f(x)\big) =$	35. $r\big(s(5)\big) =$	36. $s\big(r(2.5)\big) =$

Notes:

Comparing Function Values

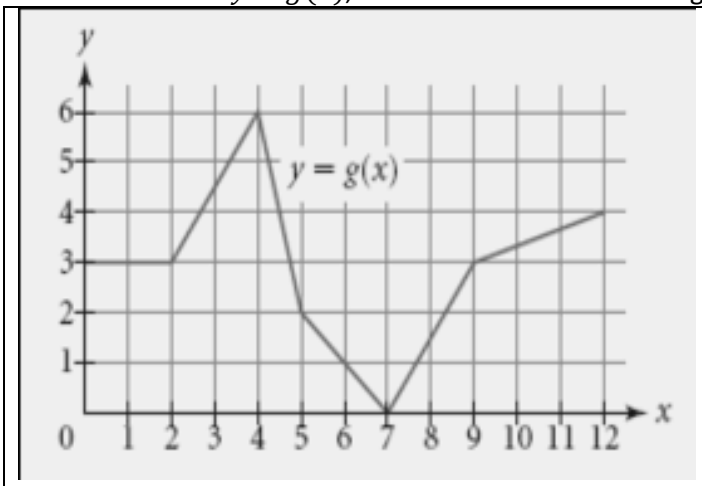
Given the functions f and g, identify each comparison with either $=$, $<$, $>$.



37. $f(1)$ ____ $g(1)$	38. $f(3)$ ____ $g(3)$
39. $f(0)$ ____ $g(0)$	40. $f(4)$ ____ $g(4)$
41. $f(2)$ ____ $g(1)$	42. $f(3)$ ____ $g(5)$
43. $f(5)$ ____ $g(.5)$	44. $f(4.5)$___ $g(1)$
45. $f(2.5)$ __$f(3.5)$	46. $g(0)$ ___$g(4.5)$

Challenge

Given the function $y = g(x)$, answer each of the following questions.



47. $g(9) =$

48. When is $g(x) = 0$?

49. $g(11) =$

50. When is $g(x) = 8$?

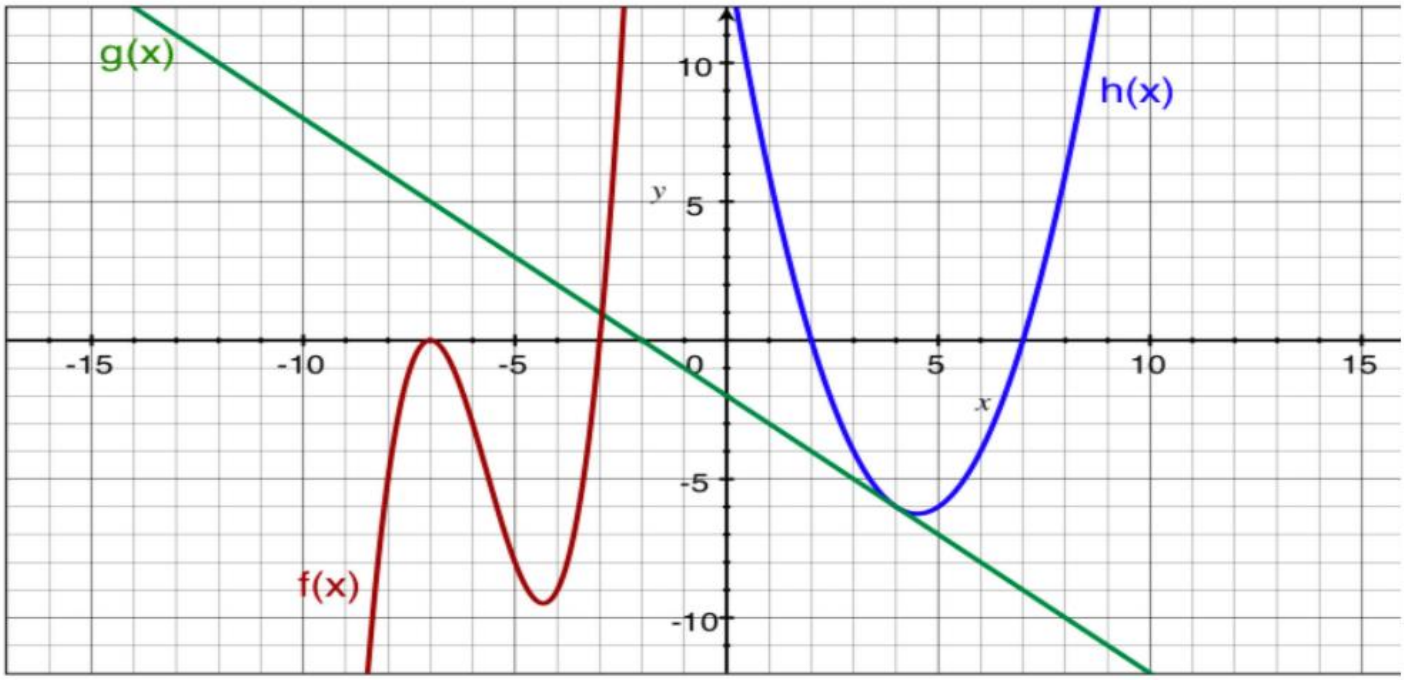
51. If $g(5) = p$, what is $g(p)$?

52. Where is $g(x) = 3$?

53. If $g(3) = r$, what is $g(r)$?

Notes:

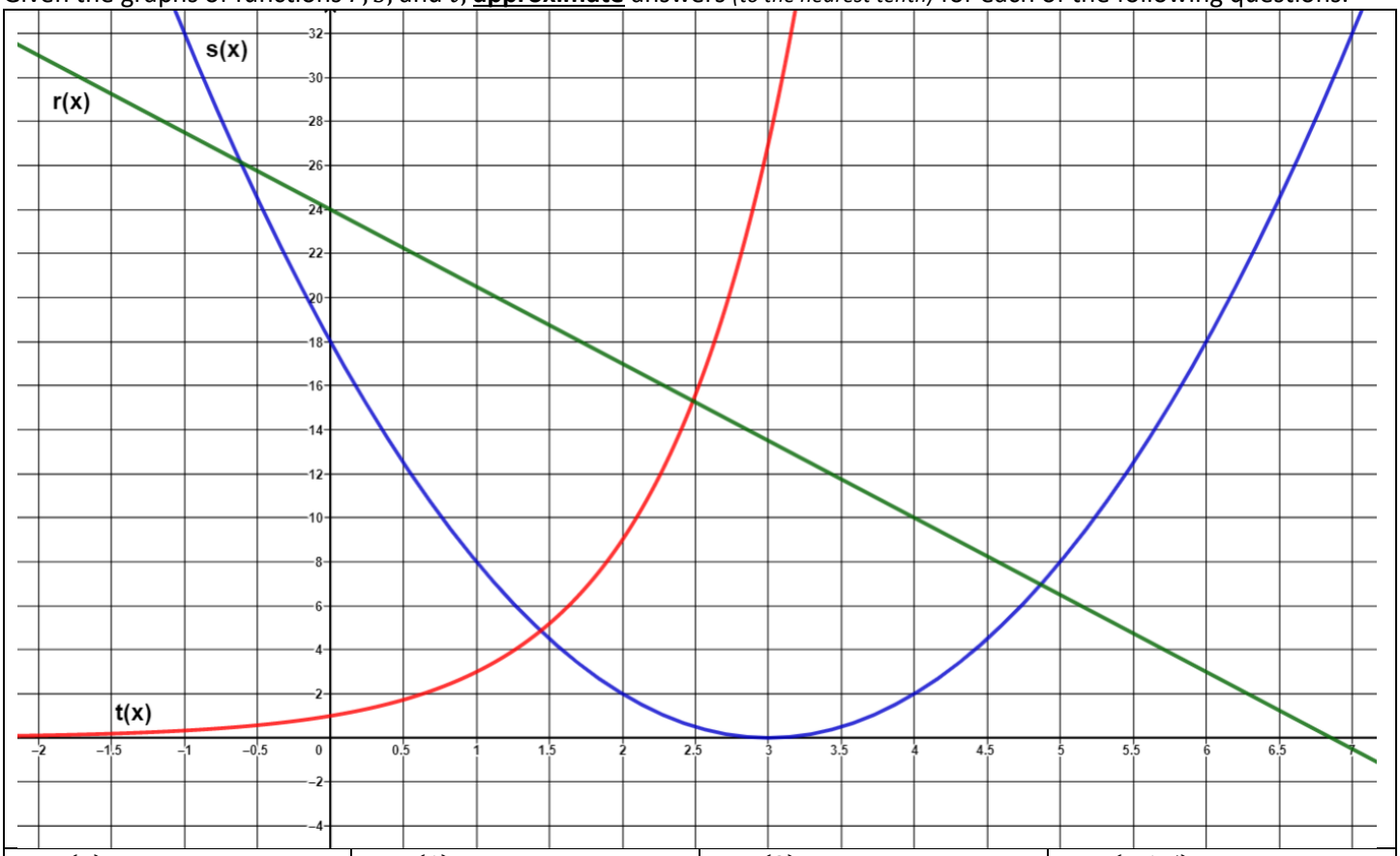
Given the graphs of functions f, g, and h, answer each of the following questions.



You may need to approximate some of these answers.

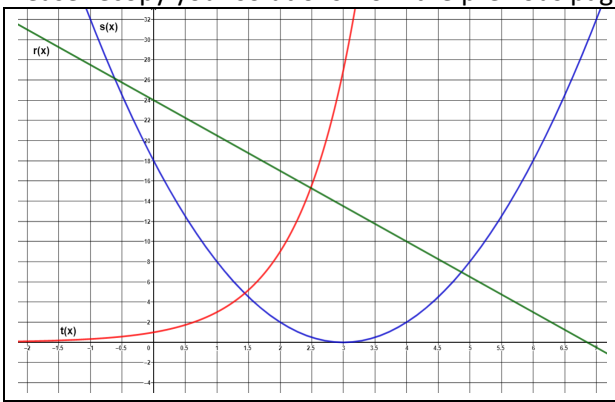
54. $h(8) =$	55. $g(-5) =$	56. $f(-5) =$
57. $g\big(f(-8)\big) =$	58. $h(2) =$	59. $f(-7) =$
60. Where is $g(x) = 0$?	61. $g(-10) =$	62. When is $g(x) = h(x)$?
63. When is $g(x) = f(x)$?	64. $g\big(h(4)\big) =$	65. $h\big(g(-9)\big) =$

Given the graphs of functions r, s, and t, **approximate** answers *(to the nearest tenth)* for each of the following questions.



1. $r(4) =$	2. $s(1) =$	3. $t(3) =$	4. $r(-1.5) =$
5. $r(r(3)) =$	6. $s(6.5) =$	7. Where is $r(x) = 0$?	8. $s(t(1)) =$
9. Where is $r(x) = t(x)$?	10. $s(r(5.5)) =$	11. $t(0) =$	12. Where is $s(x) = 0$?
13. $r(2) =$	14. Where is $r(x) = s(x)$?	15. Where is $s(x) = t(x)$?	16. $s(-1) =$

Please recopy your solutions from the previous page to help with the accuracy of the next section.



1. $r(4) =$	2. $s(1) =$	3. $t(3) =$	4. $r(-1.5) =$
5. $r(r(3)) =$	6. $s(6.5) =$	7. Where is $r(x) = 0$?	8. $s(t(1)) =$
9. Where is $r(x) = t(x)$?	10. $s(r(5.5)) =$	11. $t(0) =$	12. Where is $s(x) = 0$?
13. $r(2) =$	14. Where is $r(x) = s(x)$?	15. Where is $s(x) = t(x)$?	16. $s(-1) =$

Now something else to apply. See if you can determine the solutions to the questions below using another method.

Here are the equations for the three functions.

$r(x) = -\frac{7}{2}x + 24$	$s(x) = 2(x-3)^2$	$t(x) = 3^x$

Use a calculator (if needed) and the function equations above to evaluate each of the following.
Your solutions now must be accurate to the nearest hundredth (2 decimal places).

17. $r(4) =$	18. $s(1) =$	19. $t(3) =$	20. $r(-1.5) =$
21. $r(r(3)) =$	22. $s(6.5) =$	23. Where is $r(x) = 0$?	24. $s(t(1)) =$
25. Where is $r(x) = t(x)$?	26. $s(r(5.5)) =$	27. $t(0) =$	28. Where is $s(x) = 0$?
29. $r(2) =$	30. Where is $r(x) = s(x)$?	31. Where is $s(x) = t(x)$?	32. $s(-1) =$

Solve the following equations. You can use the information above to find the solutions…or you can use other methods.

33. $-\frac{7}{2}x + 24 = 0$	34. $-\frac{7}{2}x + 24 = 3^x$	35. $2(x-3)^2 = 0$	36. $-\frac{7}{2}x + 24 = 2(x-3)^2$	37. $2(x-3)^2 = 3^x$