

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.

ALL KINDS OF POSSIBILITIES TO CREATE \$513.

C	A
0	57
9	53
18	49
27	45
36	41
45	37
54	33
63	29
72	25
81	21
90	17
99	13
108	9
117	5
126	1

More Practice

Find four solutions for the equation $y = \frac{1}{2}x - 7$.

many Examples. HERE ARE SOME

$(10, -2)$

$(19, 2.5)$

$(20, 3)$

$(-6, -10)$

12 COMBOS. HERE ARE 4.

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.

C	A
9	30
37	18

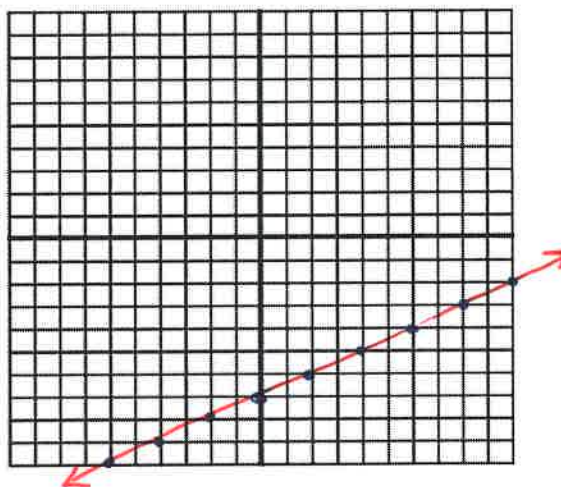
C	A
44	15
65	6

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 .

$$3x + 7y = 237$$

Graph the linear function $y = \frac{1}{2}x - 7$.

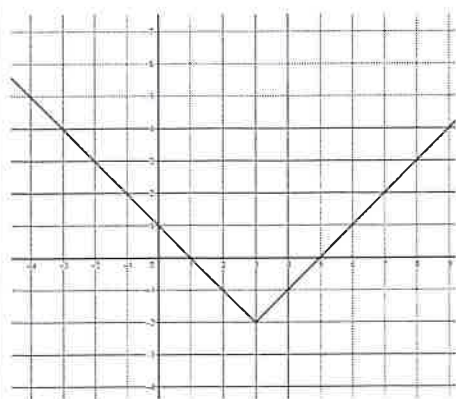


Graphing Utility Activity – Transformations Review

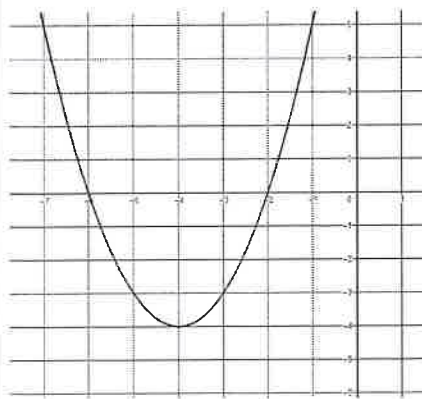
Transformation Notes:

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

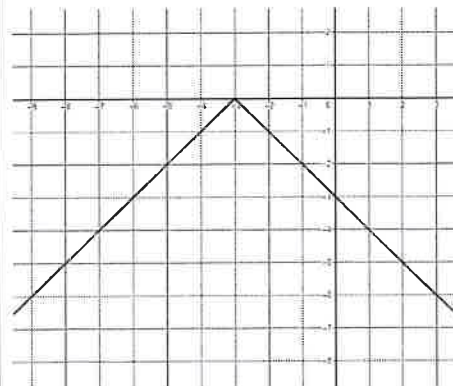
1. $y = y = |x - 3| - 2$



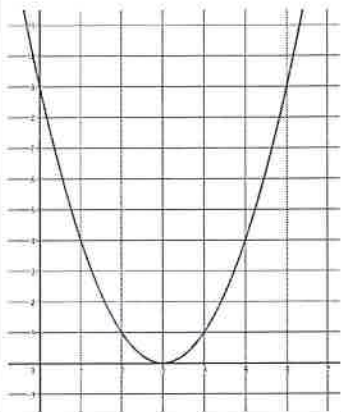
2. $y = y = (x + 4)^2 - 3$



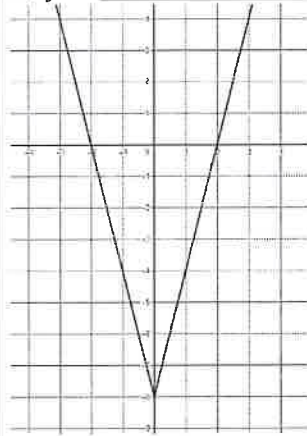
3. $y = -|x + 3|$



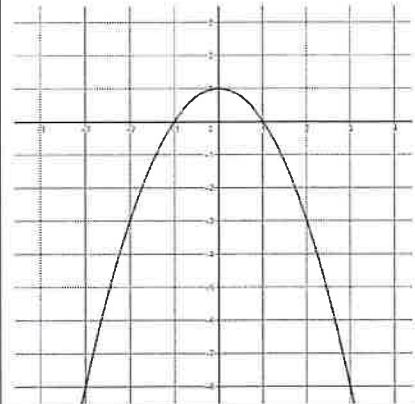
4. $y = (x-3)^2$



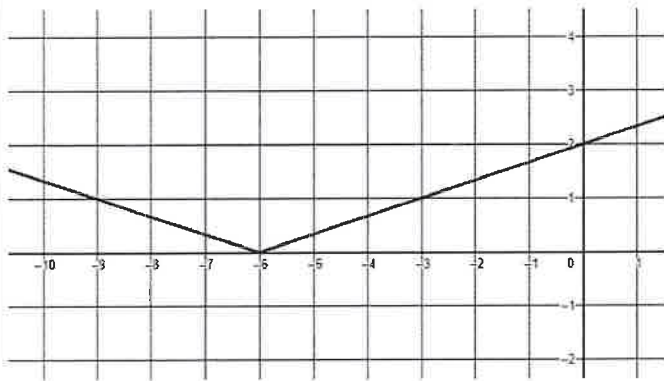
5. $y = 4|x| - 8$



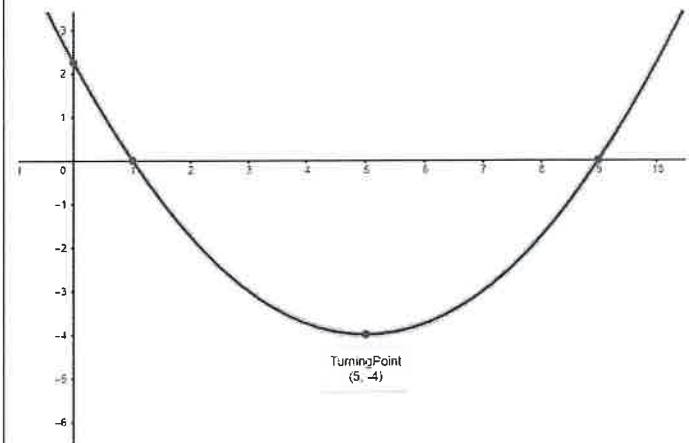
6. $y = -(x^2) + 1$



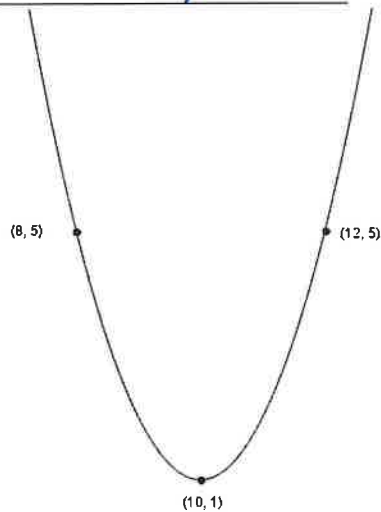
7. $y = \frac{1}{3}|x+6|$



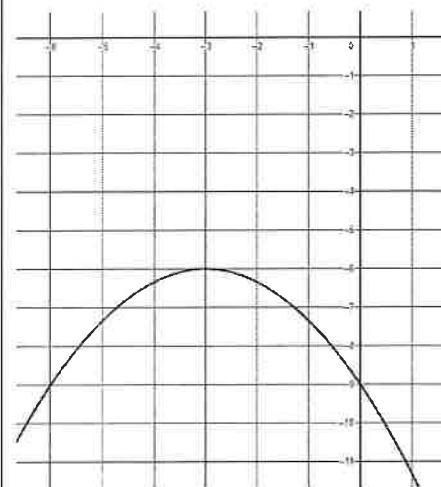
8. $y = \frac{1}{4}(x-5)^2 - 4$



9. $y = (x-10)^2 + 1$



10. $y = -(x+3)^2 - 6$



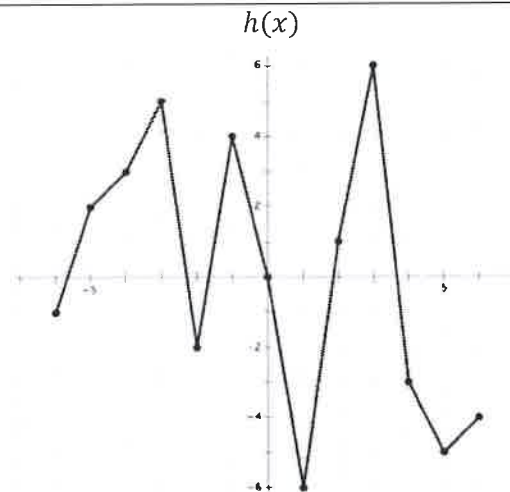
Reading and Evaluating Functions

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



(This graph uses a scale of 1 unit)

1. $g(5) = 8$

2. $h(5) = -5$

3. $f(5) = 68$

4. $h(-1) = 4$

5. $f(2) = 5$

6. $h(3) = 6$

7. $g(-2) = 6$

8. $f(0) = -7$

9. $g(0) = 2$

10. $f(-2) = 5$

11. $h(-6) = -1$

12. $f(-5) = 68$

13. $f(g(2)) = -4$

14. $g(f(2)) = 8$

15. $h(g(-1)) = 3$

16. $f(h(-5)) = 5$

17. $g(g(3)) = 2$

18. $h(h(-4)) = 6$

19. $g \circ h(2) = -7$

20. $f \circ f(2) = 68$

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
$7x + 2 = 3x + 94$ $x = 23$		
$ 2 + 5x = 3$ $x = \frac{1}{5}, -1$		
$2x^2 - 7x = 15$ $x = -1.5, 5$		
$4x^2 = -x + 3$ $x = .75, -1$		

- intersections
- zeros

- starting x
- step for x-values

DISPLAYS GRAPH

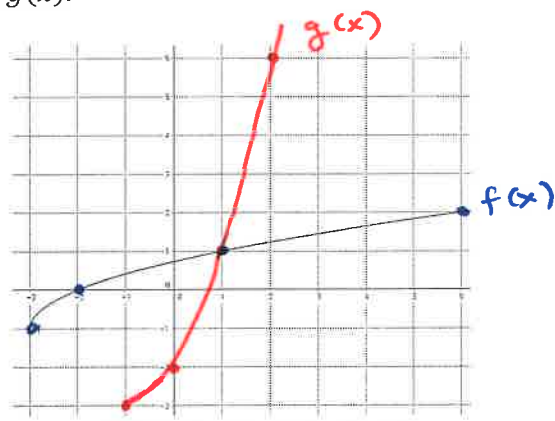
- create viewing window for your graphs

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 $g(x)$.



(This graph uses a scale of 1 unit)

Algebraically determine the inverse of the function $r(x)$ below. Call the inverse $s(x)$.

$$r(x) = \sqrt{x+5}$$

$$y = \sqrt{x+5}$$

$$x = \sqrt{y+5}$$

$$y = x^2 - 5$$

$$s(x) = x^2 - 5$$

21. $f(-2) = 0$

22. $f(6) = 2$

23. $r(-1) = 2$

24. $r(4) = 3$

25. $g(-1) = -3$

26. $g(1) = 1$

27. $s(1) = -4$

28. $s(4) = 11$

29. $f(g(2)) = 2$

30. $g(f(-3)) = -3$

31. $r(s(3)) = 3$

32. $s(r(11)) = 11$

33. $g(f(12)) = 12$

34. $g(f(x)) = x$

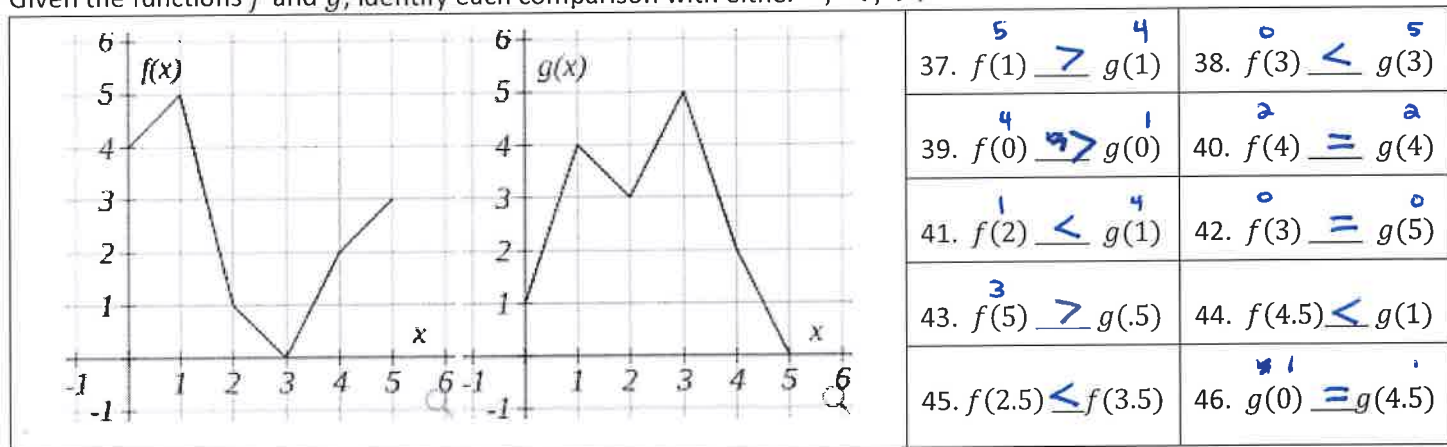
35. $r(s(5)) = 5$

36. $s(r(2.5)) = 2.5$

Notes:

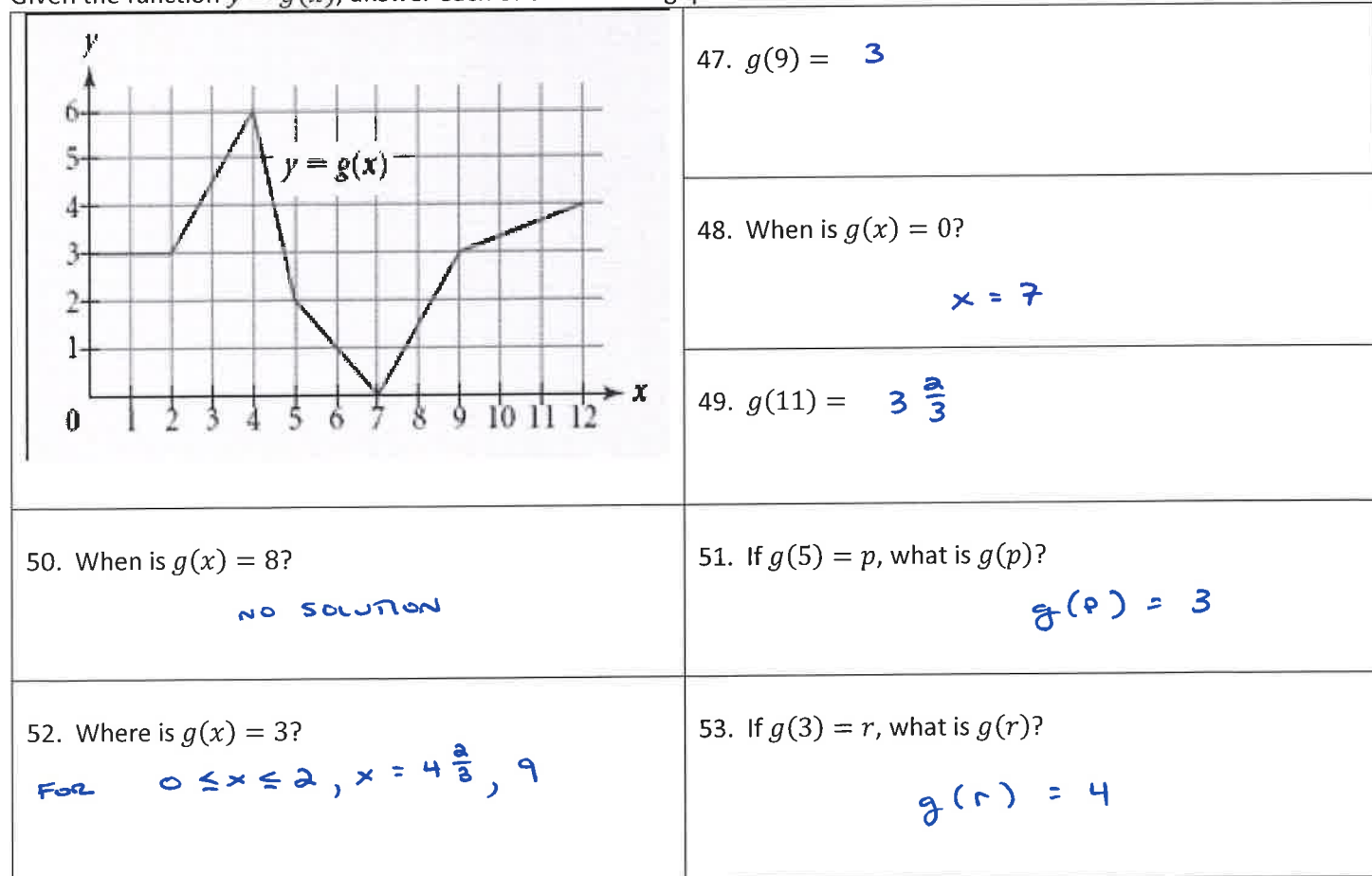
Comparing Function Values

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



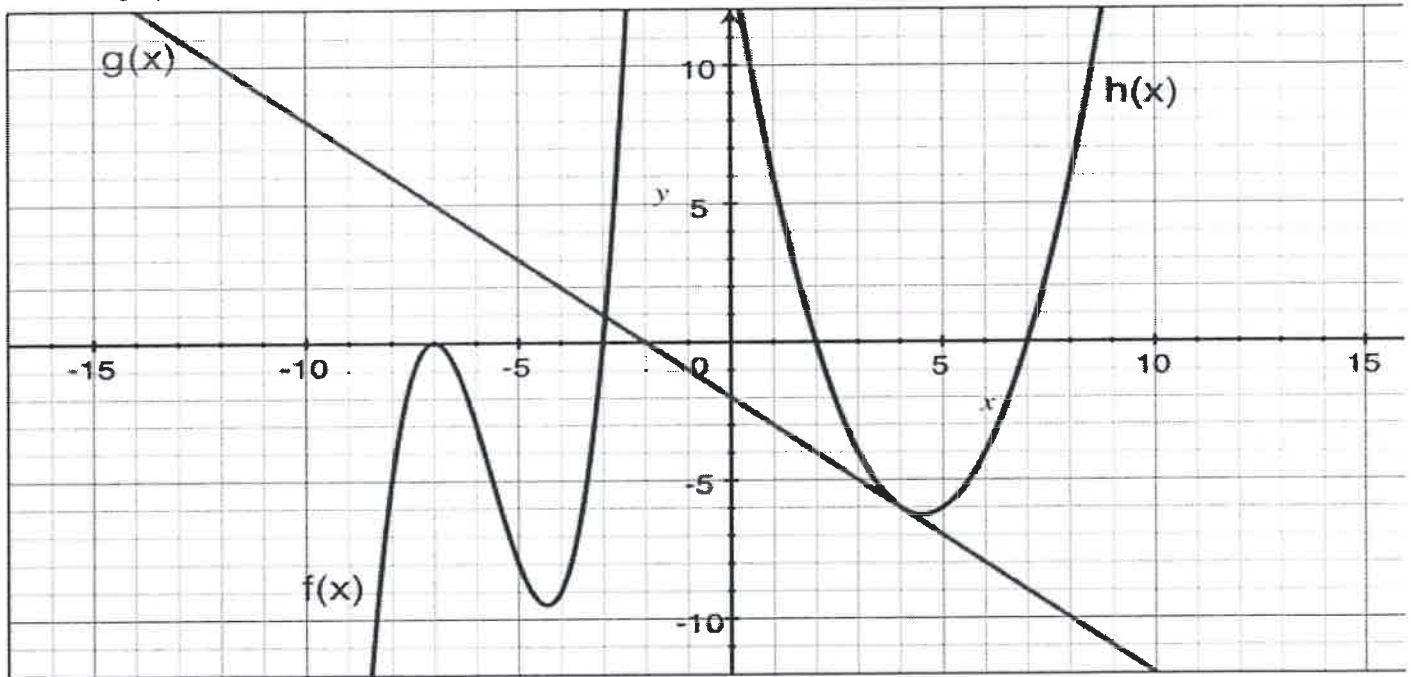
Challenge

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



Notes:

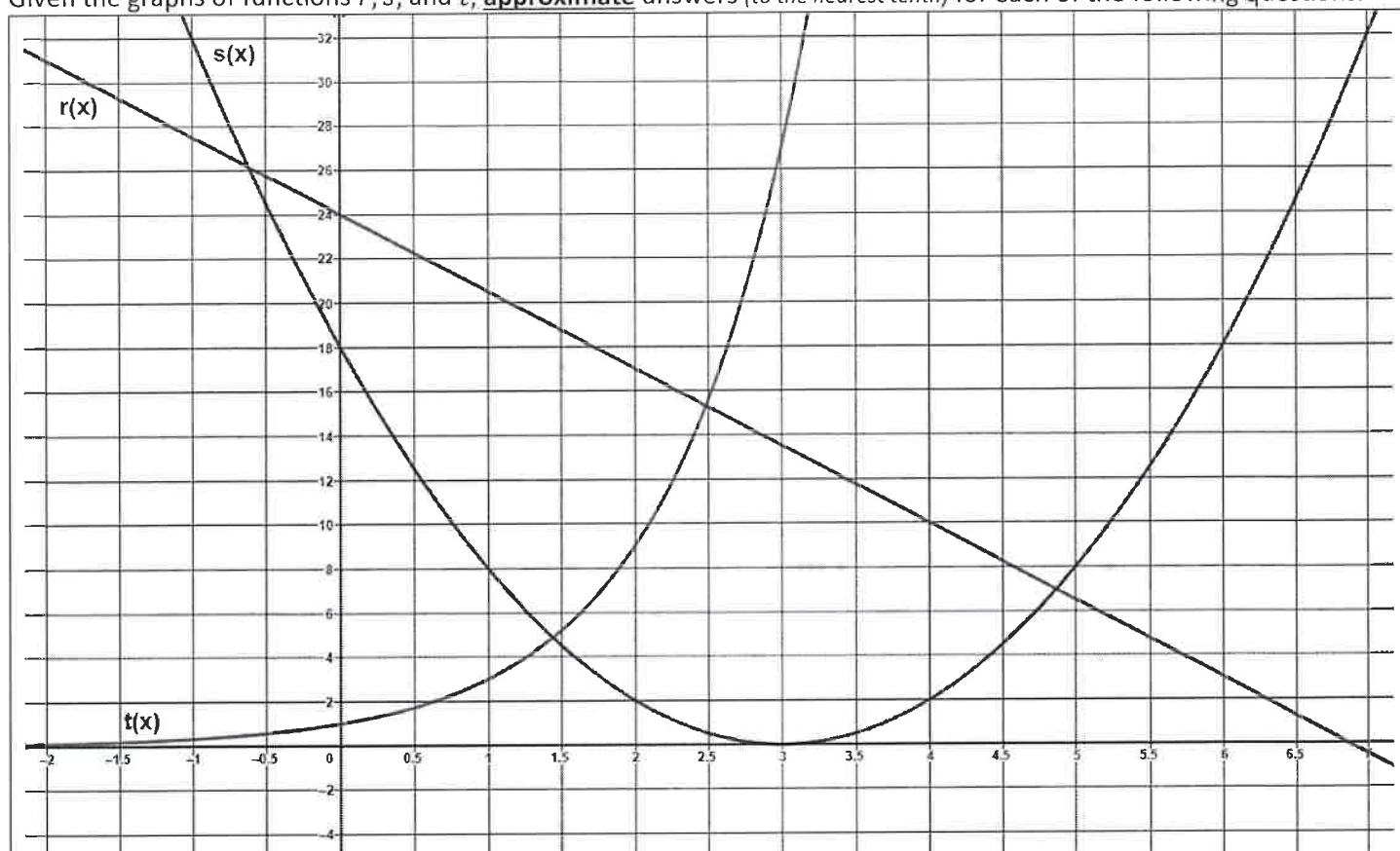
Given the graphs of functions f , g , and h , answer each of the following questions.



You may need to approximate some of these answers.

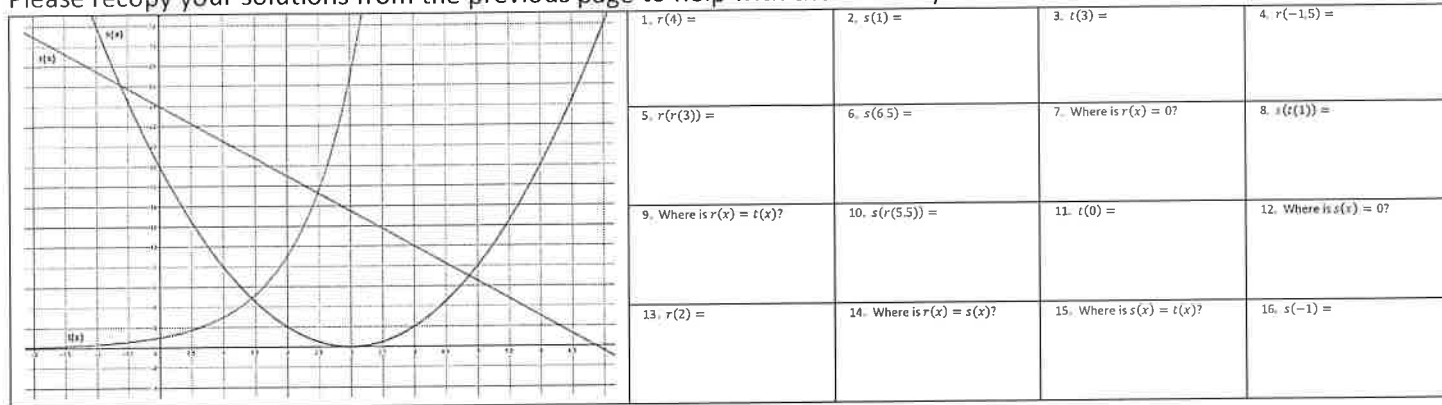
54. $h(8) = 6$	55. $g(-5) = 3$	56. $f(-5) = -8$
57. $g(f(-8)) = 3$	58. $h(2) = 0$	59. $f(-7) = 0$
60. Where is $g(x) = 0$? $x = -2$	61. $g(-10) = 8$	62. When is $g(x) = h(x)$? $x = +4$
63. When is $g(x) = f(x)$? $x = -3$	64. $g(h(4)) = 4$	65. $h(g(-9)) = 0$

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



1. $r(4) = 10$	2. $s(1) = 8$	3. $t(3) =$ ABOUT 27	4. $r(-1.5) =$ ABOUT 29.3
5. $r(r(3)) =$ ★ CHALLENGE ABOUT -23.25	6. $s(6.5) =$ ABOUT 24.5	7. Where is $r(x) = 0$? $x \approx 6.8$	8. $s(t(1)) = 0$
9. Where is $r(x) = t(x)$? $x \approx 2.47$	10. $s(r(5.5)) =$ ABOUT 6	11. $t(0) = 1$	12. Where is $s(x) = 0$? $x = 3$
13. $r(2) = 17$	14. Where is $r(x) = s(x)$? $x \approx -0.6, 4.3$	15. Where is $s(x) = t(x)$? $x \approx 1.4$	16. $s(-1) = 32$

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



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.

$r(x) = -\frac{7}{2}x + 24$	$s(x) = 2(x - 3)^2$	$t(x) = 3^x$
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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. $r(4) =$ $r(4) = -\frac{7}{2}(4) + 24$ $= 10$	18. $s(1) =$ $s(1) = 2(1-3)^2$ $= 8$	19. $t(3) =$ $t(3) = 3^3$ $= 27$	20. $r(-1.5) =$ $-\frac{7}{2}(-1.5) + 24$ $= 29.25$
21. $r(r(3)) =$ $r(3) = -\frac{7}{2}(3) + 24 = 13.5$ $r(13.5) = -\frac{7}{2}(13.5) + 24$ $= -23.25$	22. $s(6.5) =$ $s(6.5) = 2(6.5-3)^2$ $= 24.5$	23. Where is $r(x) = 0$? $-\frac{7}{2}x + 24 = 0$ $x = \frac{48}{7} \approx 6.86$	24. $s(t(1)) =$ $t(1) = 3^1 = 3$ $s(3) = 2(3-3)^2$ $= 0$
25. Where is $r(x) = t(x)$? $-\frac{7}{2}x + 24 = 3^x$ INTERSECTIONS ON CALC $x \approx 2.48$	26. $s(r(5.5)) =$ $r(5.5) = -\frac{7}{2}(5.5) + 24 = 4.75$ $s(4.75) = 2(4.75-3)^2$ $= 6.125$	27. $t(0) =$ $t(0) = 3^0$ $= 1$	28. Where is $s(x) = 0$? $2(x-3)^2 = 0$ $(x-3)^2 = 0$ $x-3 = 0$ $x = 3$
29. $r(2) =$ $r(2) = -\frac{7}{2}(2) + 24$ $= 17$	30. Where is $r(x) = s(x)$? $-\frac{7}{2}x + 24 = 2(x-3)^2$ INTERSECTIONS ON CALC $x \approx -0.62, 4.87$	31. Where is $s(x) = t(x)$? $2(x-3)^2 = 3^x$ INTERSECTIONS ON CALC $x \approx 1.44$	32. $s(-1) =$ $s(-1) = 2(-1-3)^2$ $= 32$

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

33. $-\frac{7}{2}x + 24 = 0$ SAME AS #23	34. $-\frac{7}{2}x + 24 = 3^x$ SAME AS #25	35. $2(x-3)^2 = 0$ SAME AS #28	36. $-\frac{7}{2}x + 24 = 2(x-3)^2$ SEE #30	37. $2(x-3)^2 = 3^x$ SEE #31
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