

# South Brunswick Schools

## Summer Packet For Rising Advanced Pre-Calculus Students

**Directions:** All students entering Advanced Pre-Calculus are expected to be proficient in all their previously-learned skills. The following exercises are intended to provide a review of the skills needed to be successful.

**Summer math help will be provided by honor society students. Please see the summer assignment description for dates.**

Answers to the exercises are provided on the last page – however, you must show all work to receive full credit.

We **highly recommend** that students use a graphing calculator for success in mathematics. While our math classrooms are equipped with graphing calculators for students to use during class, students are encouraged to purchase their own graphing calculator for use at home. If you choose to purchase one, we recommend the TI-83+ or TI-84. Because these calculators are costly, students should permanently mark the calculator with their name and keep them in a safe place if they bring them to school. These calculators can be used for all four years of high school mathematics as well as for other standardized tests such as the SAT so they are a worthwhile investment.

**\*\*\* Note: THIS PACKET SHOULD BE COMPLETED FOR TURN-IN ON THE FIRST DAY OF CLASS.  
YOU WILL TAKE A SKILLS QUIZ, BASED ON THIS PACKET, ON YOUR 3<sup>rd</sup> DAY OF CLASS**

Perform the indicated operation using  $f(x) = \frac{x}{4+x}$  and  $g(x) = \frac{2}{x}$ .

1.  $(f+g)(x)$

2.  $(f-g)(x)$

3.  $(f \circ g)(x)$

4.  $\left(\frac{f}{g}\right)(x)$

5.  $(f \circ g)(x)$

6.  $g(f(x))$

Graph the following piecewise functions and define the properties.

7.  $f(x) = \begin{cases} x+2 & \text{if } x \leq -1 \\ 2x & \text{if } x > -1 \end{cases}$

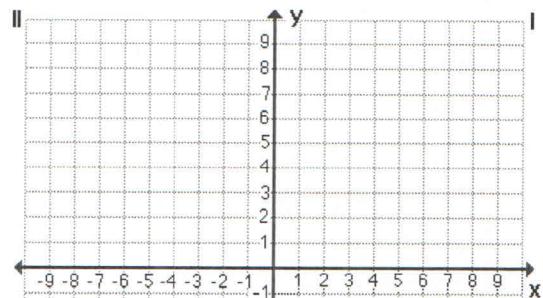
Domain: \_\_\_\_\_

Range: \_\_\_\_\_

Increasing: \_\_\_\_\_

Decreasing: \_\_\_\_\_

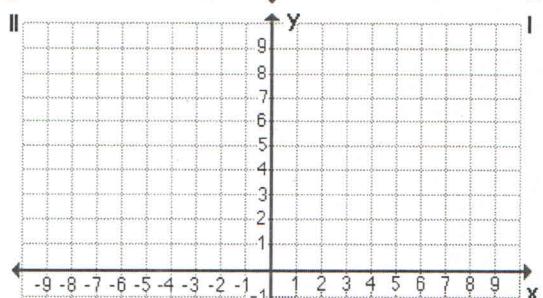
Constant: \_\_\_\_\_



8.  $f(x) = \begin{cases} -2 & \text{if } -2 \leq x \leq -1 \\ x & \text{if } -1 < x \leq 2 \\ 3x & \text{if } x > 2 \end{cases}$

Domain: \_\_\_\_\_

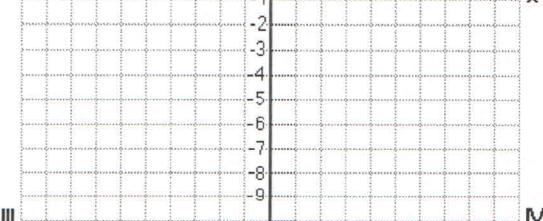
Range: \_\_\_\_\_



Increasing: \_\_\_\_\_

Decreasing: \_\_\_\_\_

Constant: \_\_\_\_\_



Given the following functions, describe the transformation of the graph and graph the parent function.

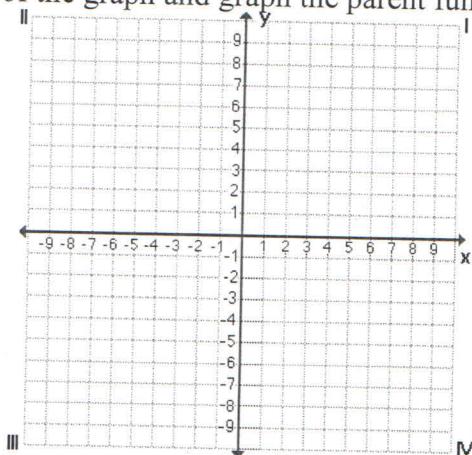
9.  $f(x) = 2|x + 2| - 4$

Transformation: \_\_\_\_\_

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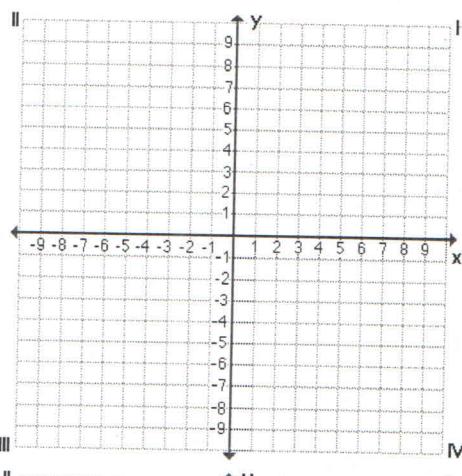
10.  $f(x) = -3(x + 4)^2 + 2$

Transformation: \_\_\_\_\_

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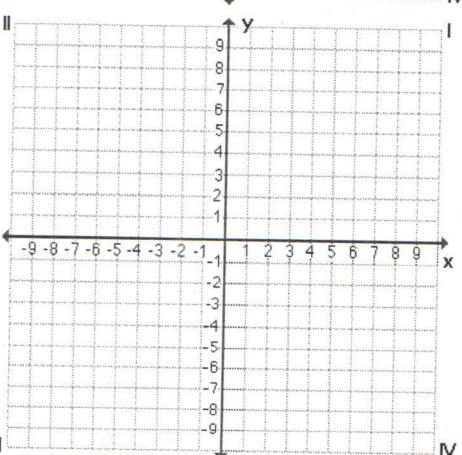
11.  $f(x) = \frac{1}{3}\sqrt{x + 2}$

Transformation: \_\_\_\_\_

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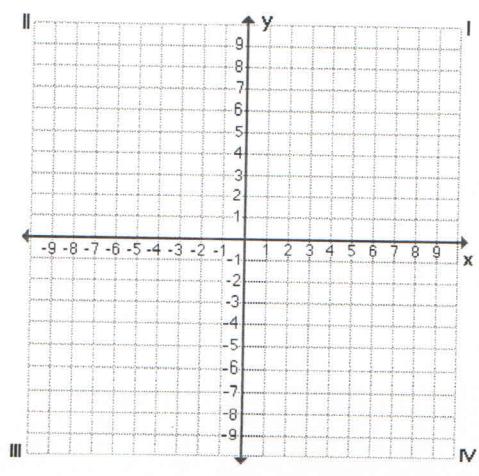
12.  $f(x) = 4(x - 3)^3 + 4$

Transformation: \_\_\_\_\_

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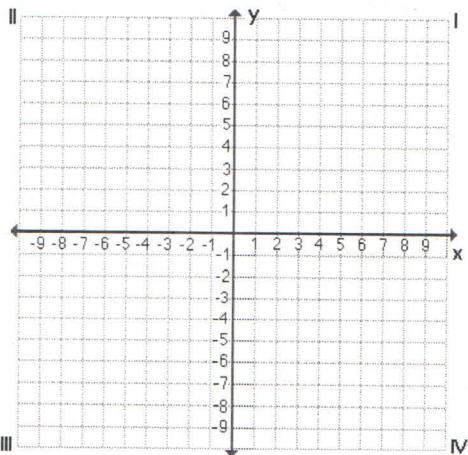
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13.  $f(x) = 2^{x+1} - 4$

Transformation: \_\_\_\_\_  
 \_\_\_\_\_  
 \_\_\_\_\_  
 \_\_\_\_\_



Graph each rational function and define the properties.

14.  $f(x) = \frac{1}{x-2} + 3$

Vertical Asymptote: \_\_\_\_\_

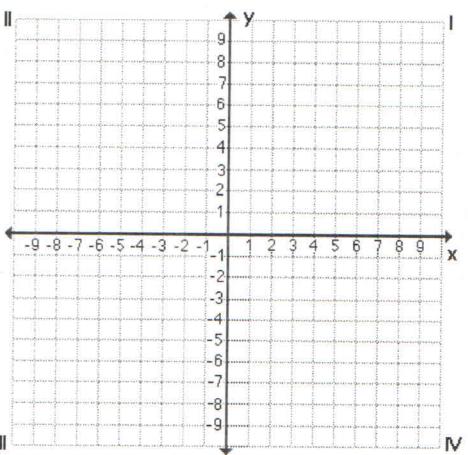
Horizontal Asymptote: \_\_\_\_\_

x-intercept(s): \_\_\_\_\_

y-intercept(s): \_\_\_\_\_

Domain: \_\_\_\_\_

Range: \_\_\_\_\_



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

Vertical Asymptote: \_\_\_\_\_

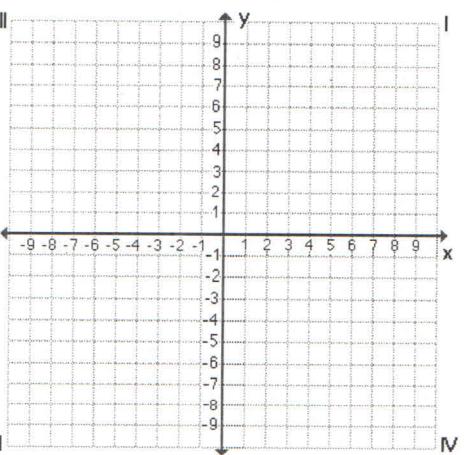
Horizontal Asymptote: \_\_\_\_\_

x-intercept(s): \_\_\_\_\_

y-intercept(s): \_\_\_\_\_

Domain: \_\_\_\_\_

Range: \_\_\_\_\_



Determine whether  $f$  has an inverse function. If it does, find the inverse function and state any restrictions on the domain.

16.  $f(x) = -16 + x^3$

17.  $f(x) = \frac{x+7}{x}$

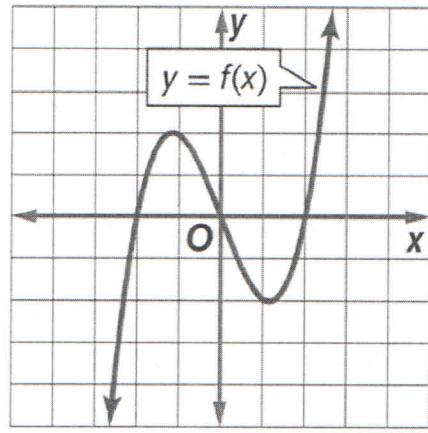
18.  $f(x) = 2\sqrt{x-1}$

Show that  $f$  and  $g$  are inverse functions.

19.  $f(x) = 18 - 3x, g(x) = 6 - \frac{x}{3}$

20.  $f(x) = x^2 + 10, x \geq 0; g(x) = \sqrt{x-10}$

21. Use the graph of  $f(x)$  to graph  $f^{-1}(x)$ .



Simplify each expression.

22.  $\sqrt[6]{x^{12}y^{15}}$

23.  $\sqrt[3]{8a^9b^7}$

24.  $\sqrt{25r^5t^4u^2}$

25.  $\sqrt[5]{32x^{11}y^{20}z^5}$

26.  $\frac{x^{\frac{1}{2}}}{x^{\frac{1}{4}}}$

27.  $\frac{\sqrt[8]{49}}{\sqrt[6]{7}}$

28. Solve: 
$$\begin{cases} x + 3y + 2z = 5 \\ 3x + y - 2z = 7 \\ 2x + 2y + 3z = 3 \end{cases}$$

Use a system of three variables to solve.

29. Larry, Camille, and Simone are keeping track of how far they walk each day. At the end of the week, they combined their distances and found that they had walked 34 miles in total. They also learned that Camille walked twice as far as Larry, and that Larry walked 2 more miles than Simone. How far did each person walk?
30. Alexandria High School scored 37 points in a football game. Six points are awarded for each touchdown. After each touchdown, the team can earn one point for the extra kick or two points for a 2-point conversion. The team scored one fewer 2-point conversions than extra kicks. The team scored 10 times during the game. How many touchdowns were made during the game?

**Graphing Calculator:** You should be familiar with the graphing features of the TI-83/TI-84 graphing calculators such as entering equations, graphing the equation, changing the window and table if necessary, entering data from a table, and graphing its scatterplot. Below is a link to the Texas Instruments products page for their graphing calculators. You will find the guidebooks for each graphing calculator that are available to download. <http://tinyurl.com/TIgraphingcalculators>

### **Free! Online Calculators**

Meta Calculator is a free graphing calculator, statistics calculator, matrix calculator and scientific calculator. Desmos has a graphing calculator that works on iPad as well as desktops.

**Vocabulary Review:**

Absolute Value Function	Independent Variable	Range
Composition	Index	Reciprocal Function
Cubic Function	Interval notation	Reflection
Dependent Variable	Inverse Function	Roots
Domain	Inverse Relation	Square Root Function
Dilation	Parent Function	Step Function
Function	Piecewise Function	Transformation
Function notation	Quadratic Function	Translation
		Zeros

$$1. \frac{x^2 + 2x + 8}{(4+x)x}$$

$$2. \frac{x^2 - 2x - 8}{(4+x)x}$$

$$3. \frac{2}{4+x}$$

$$4. \frac{x^2}{8+2x}$$

$$5. \frac{1}{2x+1}$$

$$6. \frac{8+2x}{x}$$

$$7. f(x) = \begin{cases} x+2 & \text{if } x \leq -1 \\ 2x & \text{if } x > -1 \end{cases}$$

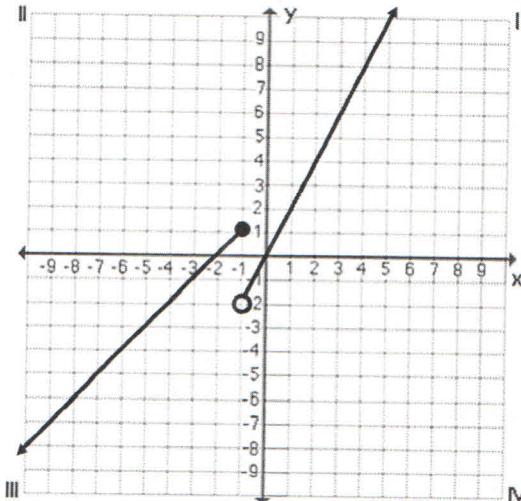
Domain:  $(-\infty, \infty)$

Range:  $(-\infty, \infty)$

Increasing:  $(-\infty, \infty)$

Decreasing: N/A

Constant: N/A



$$8. f(x) = \begin{cases} -2 & \text{if } -2 \leq x \leq -1 \\ x & \text{if } -1 < x \leq 2 \\ 3x & \text{if } x > 2 \end{cases}$$

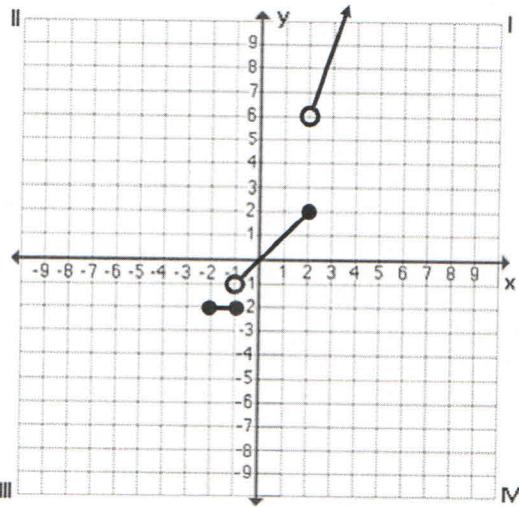
Domain:  $[-2, \infty)$

Range:  $[-2] \cup (-1, 2] \cup (6, \infty)$

Increasing:  $(-1, 2], (6, \infty)$

Decreasing: N/A

Constant:  $[-2]$

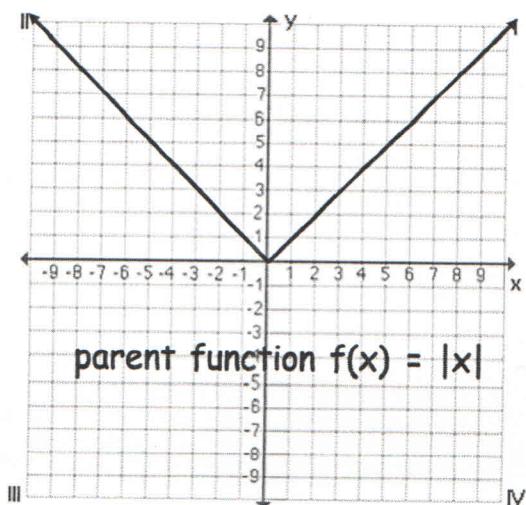


$$9. f(x) = 2|x+2| - 4$$

Transformation:

Vertically expanded by factor of 2

2 units left, 4 units down



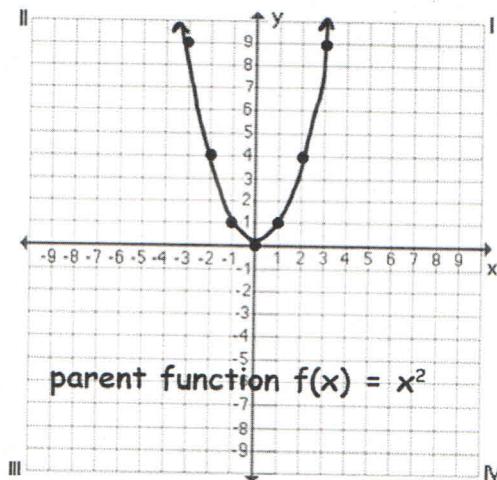
10.  $f(x) = -3(x + 4)^2 + 2$

Transformation:

Reflected over x axis

Vertically expanded by factor of 3

4 units left, 2 units up

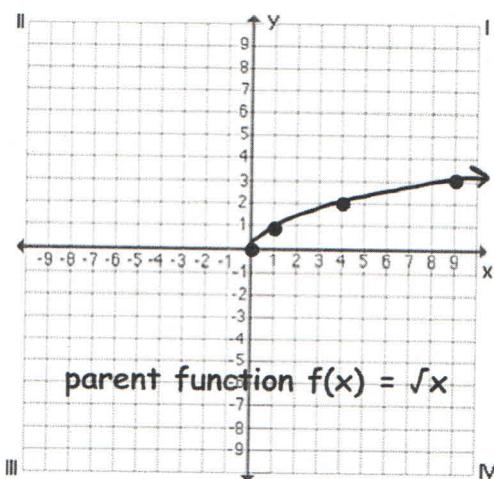


11.  $f(x) = \frac{1}{3}\sqrt{x+2}$

Transformation:

Vertically compressed by factor of  $\frac{1}{3}$

2 units left

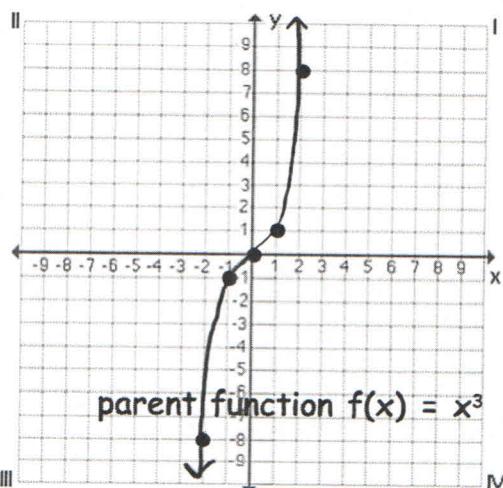


12.  $f(x) = 4(x - 3)^3 + 4$

Transformation:

Vertically expanded by factor of 4

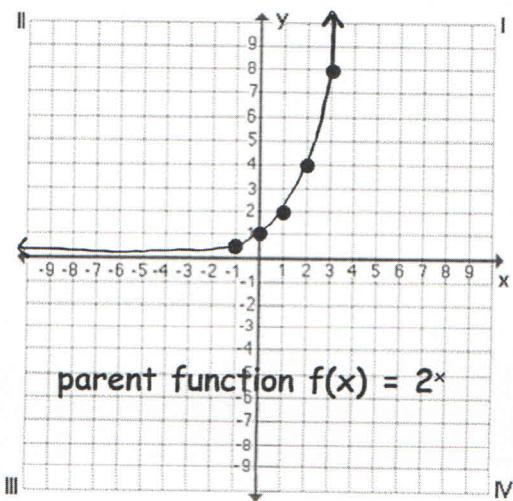
3 units right, 4 units up



13.  $f(x) = 2^{x+1} - 4$

Transformation:

1 unit left, 4 units down



14.  $f(x) = \frac{1}{x-2} + 3$

Vertical Asymptote:  $x = 2$

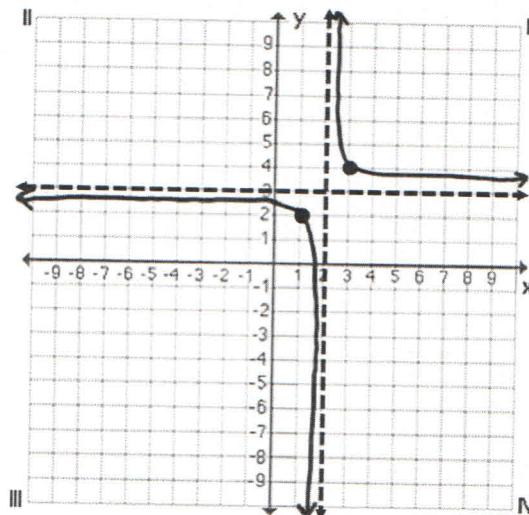
Horizontal Asymptote:  $y = 3$

$x$ -intercept(s):  $\left(\frac{5}{3}, 0\right)$

$y$ -intercept(s):  $(0, 2.5)$

Domain:  $(-\infty, 2) \cup (2, \infty)$

Range:  $(-\infty, 3) \cup (3, \infty)$



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

Vertical Asymptote:  $x = -1$

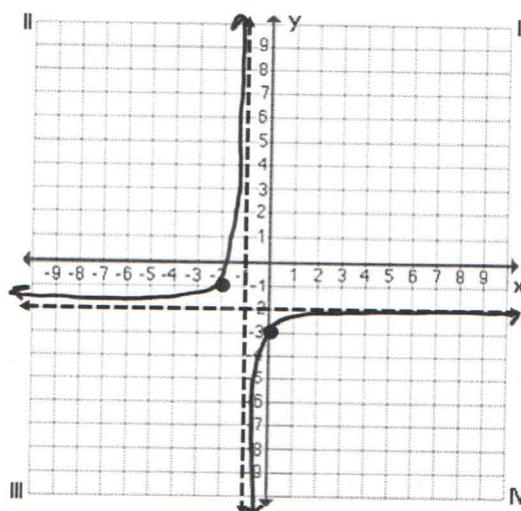
Horizontal Asymptote:  $y = -2$

$x$ -intercept(s):  $\left(-\frac{3}{2}, 0\right)$

$y$ -intercept(s):  $(0, -3)$

Domain:  $(-\infty, -1) \cup (-1, \infty)$

Range:  $(-\infty, -2) \cup (-2, \infty)$



16. yes;  $f^{-1}(x) = \sqrt[3]{x+16}$

17. Yes;  $f^{-1}(x) = -\frac{7}{1-x}; x \neq 1$

18. No

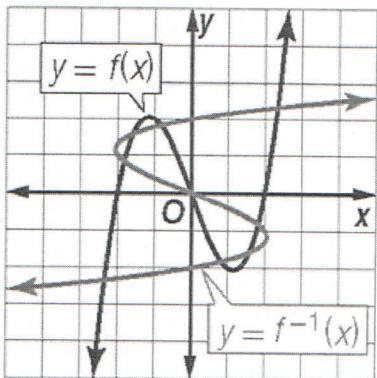
19. 
$$\begin{aligned}f[g(x)] &= 18 - 3\left(6 - \frac{x}{3}\right) \\&= 18 - 18 + x \\&= x;\end{aligned}$$

$$\begin{aligned}g[f(x)] &= 6 - \frac{18 - 3x}{3} \\&= 6 - 6 + x \\&= x\end{aligned}$$

20. 
$$\begin{aligned}f[g(x)] &= (\sqrt{x-10})^2 + 10 \\&= x-10+10 \\&= x;\end{aligned}$$

$$\begin{aligned}g[f(x)] &= \sqrt{x^2 + 10} - 10 \\&= x\end{aligned}$$

21.



22.  $x^2 y^2 \sqrt[6]{y^3}$

23.  $2a^3 b^2 \sqrt[3]{b}$

24.  $5r^2 t^2 |u| \sqrt{r}$

25.  $2x^2 y^4 z \sqrt[5]{x}$

26.  $x^{\frac{1}{4}}$

27.  $\sqrt[12]{7}$

28. (1,2,-1)

29. Larry: 9 miles, Camille: 18 miles, Simone: 7 miles

30. Touchdowns: 5