

Review for the Test: Function Operations, Inverses, and Radical Equations

Choose the best answer.

- D 1. Which set of ordered pairs does NOT represent a function?
- A.  $\{(-5,7), (7,-5), (8,-3), (-3,8)\}$       B.  $\{(-5,7), (8,5), (2,-8), (10,-2)\}$
- C.  $\{(-5,7), (2,7), (8,7), (10,7)\}$       D.  $\{(-5,7), (8,-3), (-3,5), (-5,-8)\}$

-5 has 2 outputs  
 $\therefore D$  is not a function

2. If  $f(x) = -6x - 5$  and  $g(x) = x^2 + 6$ , then  $f(g(-4))$  is equal to?

First, find  $g(-4)$   
 $g(-4) = (-4)^2 + 6$   
 $16 + 6$   
 $22 \rightarrow$

$f(g(-4)) = -137$

Now find  $f(22) \rightarrow$   
 $-6(22) - 5$   
 $-132 - 5$   
 $-137$

3. Find the inverse of the function  $f(x) = \sqrt{x-5}$

$y = \sqrt{x-5}$        $x = \sqrt{y-5}$   
 $x^2 = y-5$   
 $x^2 + 5 = y$   
 $y = x^2 + 5$

4. Solve  $\sqrt[3]{x+2} - 15 = -11$

$\sqrt[3]{x+2} = 4$   
 $x+2 = 64 \rightarrow x = 62$

5. What is the solution set of the equation  $\sqrt{3x+18} = x$ ?

$3x+18 = x^2$   
 $x^2 - 3x - 18 = 0$

$(x-6)(x+3) = 0$   
 $x = 6, x = -3$  ← this is extraneous

6. What is the solution of the equation  $5x^{5/3} = 160$ ?

$x^{5/3} = 32$   
 $x = (32)^{3/5} \rightarrow x = 8$

7. Given  $f(x) = -4x - 9$  and  $g(x) = -6x^2 - 11$ , find  $f(x) - g(x)$

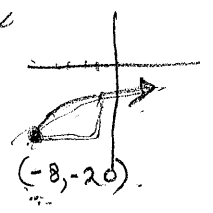
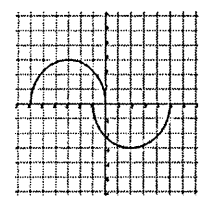
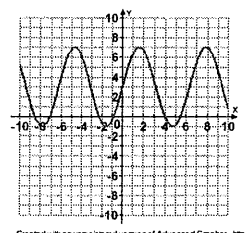
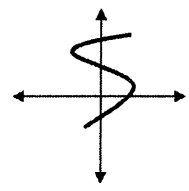
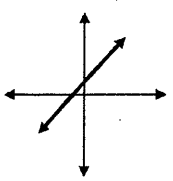
$(-4x-9) - (-6x^2-11) \rightarrow -4x-9+6x^2+11 \rightarrow 6x^2-4x+2$

8. What is the domain of the function  $y = \sqrt{x+8} - 20$ ?

RANGE:  $[-20, +\infty)$   
 the vertex is  $(-8, -20)$   
 $\therefore$  DOMAIN is  $[-8, +\infty)$

this is a square root graph that is continuous to the right of the vertex

9. Which of these graphs is one-to-one?



A.

GRAPH A passes both the vertical and horizontal line test

**GRAVITY** Isabel accidentally dropped her keys from the top of a Ferris wheel. The formula  $t = \frac{1}{4}\sqrt{d-h}$  describes the time  $t$  in seconds at which the keys are  $h$  meters above the ground and Isabel is  $d$  meters above the ground. If Isabel was 65 meters high when she dropped the keys, how many meters above the ground will the keys be after 2 seconds?

$$2 = \frac{1}{4}\sqrt{65-h}$$

$$8 = \sqrt{65-h}$$

$$64 = 65-h$$

$$-1 = -h$$

$$h = 1 \text{ meter}$$

Let the functions be defined as  $f(x) = 6x - 18$      $g(x) = x^2 - 9$      $h(x) = -3x$      $j(x) = x - 12$

Find all the following and state any domain restrictions.

11.  $f(x) - h(x)$   $9x - 18$

$$(6x - 18) - (-3x)$$

$$6x - 18 + 3x$$

12.  $f(x) \cdot j(x)$   $6x^2 - 90x + 216$

$$(6x - 18)(x - 12)$$

$$6x^2 - 72x - 18x + 216$$

$$6x^2 - 90x + 216$$

13.  $\frac{f(x)}{g(x)}$   $\frac{6}{x+3}, x \neq 3, x \neq -3$

$$\frac{6x - 18}{x^2 - 9} \rightarrow \frac{6(x-3)}{(x-3)(x+3)} \rightarrow \frac{6}{x+3}$$

14.  $-5h(x) + 6j(x)$   $21x - 72$

$$-5(-3x) + 6(x - 12)$$

$$15x + 6x - 72$$

15.  $h(g(x))$   $-3x^2 + 27$

$$-3(x^2 - 9)$$

$$-3x^2 + 27$$

16.  $g(j(2))$   $91$

$$g(-10)$$

17.  $j(g(x))$   $x^2 - 21$

$$(x^2 - 9) - 12$$

$$x^2 - 21$$

18.  $f(g(h(j(-3))))$   $12,078$

$$-15$$

$$45$$

$$2016$$

$$12,078$$

Find the inverse of the following functions. Show all steps.

19.  $f(x) = \frac{1}{5}x + 7$   $y = 5x - 35$

$$y = \frac{1}{5}x + 7$$

$$x = \frac{1}{5}y + 7$$

$$5(x - 7) = \frac{1}{5}y$$

20.  $f(x) = (x-5)^2 + 8$   $y = 5 \pm \sqrt{x-8}$

$$y = (x-5)^2 + 8$$

$$x = (y-5)^2 + 8$$

$$x - 8 = (y-5)^2$$

$$\pm \sqrt{x-8} = y - 5$$

To prove function composition,

show that  $f(g(x)) = x$  and show that  $g(f(x)) = x$

21. Use function composition to verify that  $f(x) = 6x + 18$  and  $g(x) = \frac{1}{6}x - 3$  are inverses of each other.

$$f(g(x)) = 6 \left[ \frac{1}{6}x - 3 \right] + 18$$

DISTRIBUTE!

$$x - 18 + 18$$

$$x$$

$$g(f(x)) = \frac{1}{6} [6x + 18] - 3$$

DISTRIBUTE!

$$x + 3 - 3$$

$$x //$$

Solve. Check for extraneous solutions.

22.  $\sqrt[3]{x} - 20 = -25$

$$\sqrt[3]{x} = -5$$

$$x = (-5)^3$$

$x = -125$

23.  $(x-2)^{\frac{1}{4}} = (40)^{\frac{1}{4}}$

$$x - 2 = \pm 2.51 \dots$$

$$x = 2 \pm 2.51 \dots$$

$x \approx 4.51, x \approx -0.51$

24.  $7\sqrt{5x-7} = 84$

$$\sqrt{5x-7} = 12$$

$$5x-7 = 144$$

$$5x = 151$$

$x = \frac{151}{5}$

$x = \frac{151}{5}$

25.  $\sqrt{6x+9} = 3\sqrt{x}$

$$6x+9 = 9x$$

$$9 = 3x$$

$$x = 3$$

$x = 3$

26.  $\sqrt{5x-2} = \sqrt{4x+8}$

$$5x-2 = 4x+8$$

$$x-2 = 8$$

$$x = 10$$

$x = 10$

27.  $x^9 + 55 = 427$

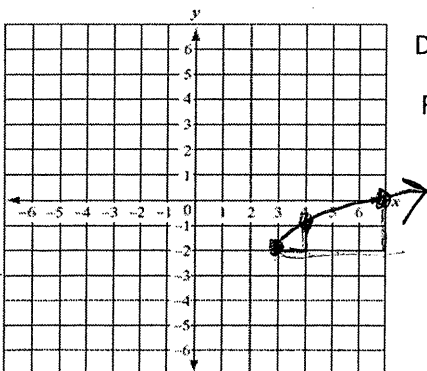
$$x^9 = 372$$

$$x = (372)^{\frac{1}{9}}$$

$x \approx 1.930$

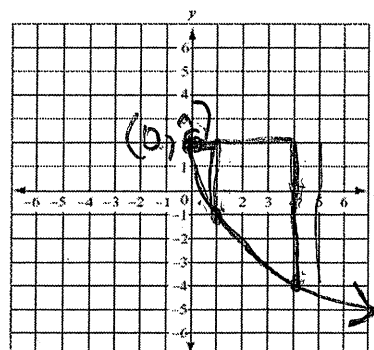
Sketch a graph of each function, then identify the domain and range using interval notation.

28.  $f(x) = \sqrt{x-3} - 2$



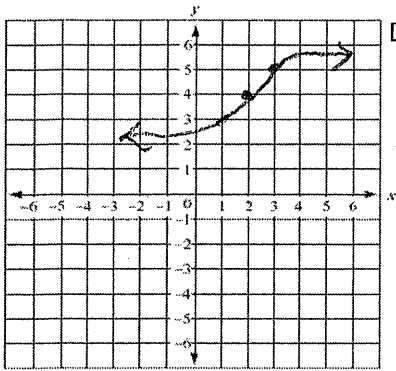
Domain  $[3, +\infty)$   
Range  $[-2, +\infty)$

29.  $f(x) = -\sqrt{9x} + 2$



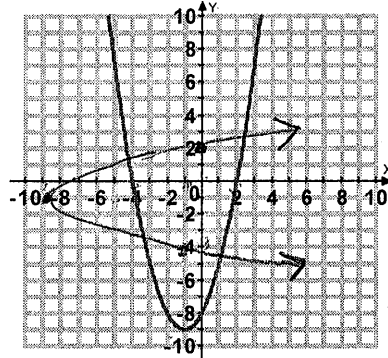
Domain  $[0, +\infty)$   
Range  $(-\infty, 2]$

30.  $f(x) = \sqrt[3]{x-2} + 4$



Domain all  $\mathbb{R}$   
 Range all  $\mathbb{R}$

31. The graph of  $f(x)$  is shown below.  
 Sketch the inverse of the graph on the same grid.



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Is the inverse a function? How do you know? No; the graph fails the **HORIZONTAL LINE TEST**. Write the domain and range of the inverse relation.  
 D:  $[-9, +\infty)$   
 R: all  $\mathbb{R}$

32. **WEIGHTLIFTING** The formula  $M = 512 - 146,230B^{-8/5}$  can be used to estimate the maximum total mass that a weightlifter of mass  $B$  kilograms can lift using the snatch and the clean and jerk. According to the formula, how much does a person weigh who can lift at most 470 kilograms?

$B$  = weightlifter's body mass  
 $M$  = how much person can lift

$$470 = 512 - 146,230 B^{-8/5}$$

$$-42 = -146,230 B^{-8/5}$$

$$42 = 146,230 B^{-8/5}$$

$$\left(\frac{42}{146,230}\right)^{5/8} = (B^{8/5})^{5/8}$$

$$\approx 163.5 \text{ KG}$$

33. **PACKAGING** A cylindrical container of chocolate drink mix has a volume of 162 cubic inches. The radius  $r$  of the container can be found by using the formula

$$r = \sqrt{\frac{V}{\pi h}}, \text{ where } V \text{ is the volume of the container and } h \text{ is the height.}$$

- If the radius is 2.5 inches, find the height of the container. Round your answer to the nearest hundredth.
- If the height of the container is 10 inches, find the radius of the container. Round to the nearest hundredth

a.  $2.5 = \sqrt{\frac{162}{\pi h}}$

$$\frac{(2.5)^2}{1} = \frac{162}{\pi h}$$

$$(6.25)(\pi)(h) = 162$$

$$h = \frac{162}{(6.25)(\pi)} \approx 8.25 \text{ in}$$

b.  $r = \sqrt{\frac{162}{\pi(10)}}$

$$r = \sqrt{\frac{162}{10\pi}}$$

$$r \approx 2.27 \text{ in}$$