$f(x)=\sqrt{x}$

x	y
0	0
1	1
4	2
9	3

$f(x)=\sqrt[3]{x}$

x	y
-8	-2
-1	-1
0	0
8	2

Name ______________________

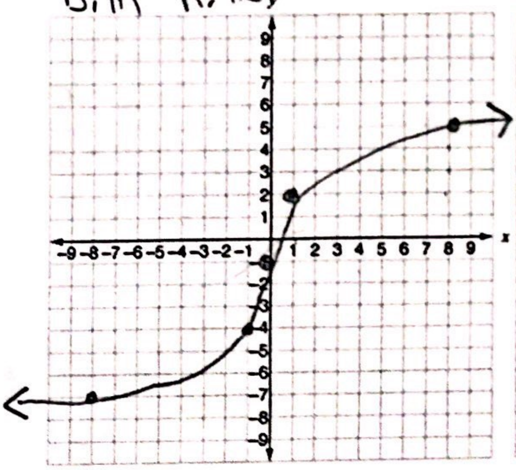
Sketch the graph of each function. List the domain and range. List the transformations from the parent function.

1) $y = 3\sqrt[3]{x} - 1$

x	3y-1
-8	-7
-1	-4
0	-1
1	2
8	5

- vertical stretch by 3
- vertical shift down 1

D: ℝ R: ℝ

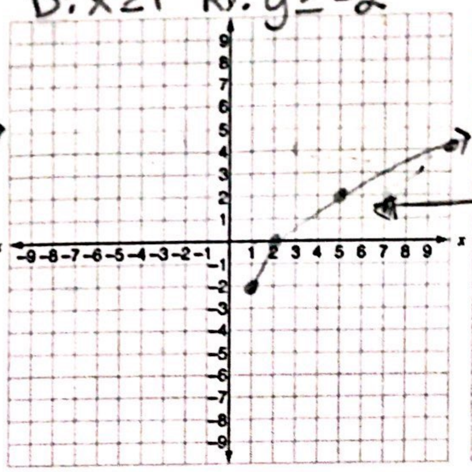


2) $y = 2\sqrt{x-1} - 2$

x+1	2y-2
1	-2
2	0
5	2
10	4

- right 1
- vertical stretch by 2
- down 2

D: $x \geq 1$ R: $y \geq -2$

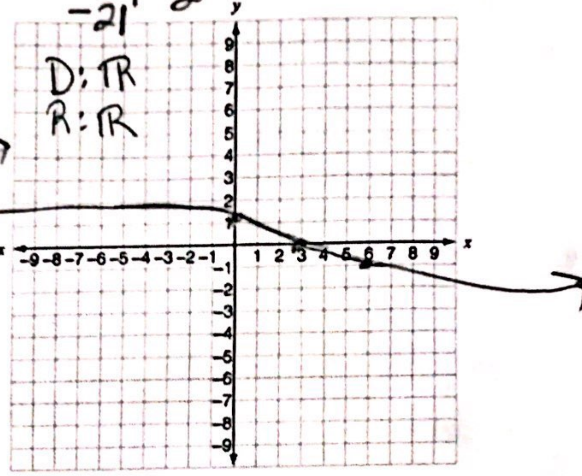


3) $y = \sqrt[3]{-\frac{1}{3}x + 1}$ $= \sqrt[3]{-\frac{1}{3}(x-3)}$

-3x+3	y
27	-2
6	-1
3	0
0	1
-21	2

- horizontal stretch by 3
- right 3
- reflect over the y-axis

D: ℝ
R: ℝ

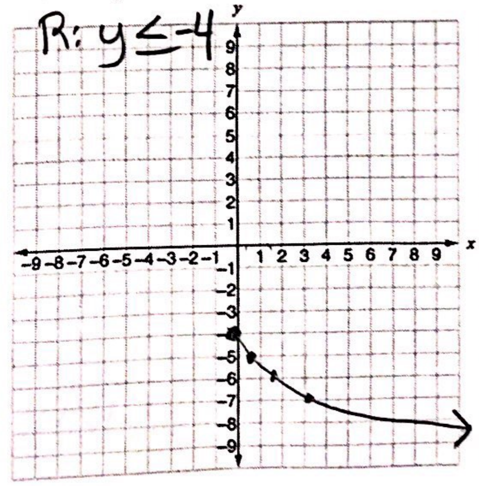


4) $y = -\sqrt{3x} - 4$

$\frac{1}{3}x$	-y-4
0	-4
1/3	-5
4/3	-6
3	-7

- horizontal shrink by 1/3
- reflect over x-axis
- down 4

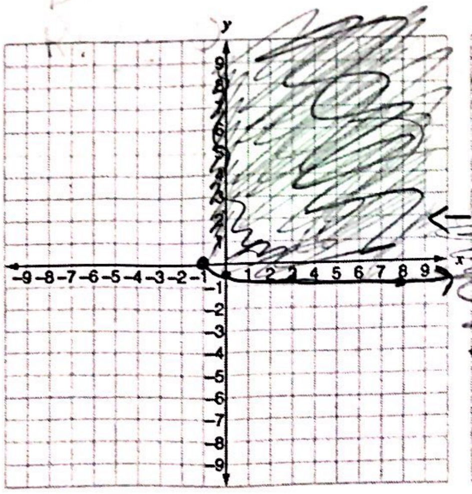
D: $x \geq 0$
R: $y \leq -4$



5) $y \geq -\frac{1}{3}\sqrt{x+1}$

x-1	$-\frac{1}{3}y$
-1	0
0	-1/3
3	-2/3
8	-1

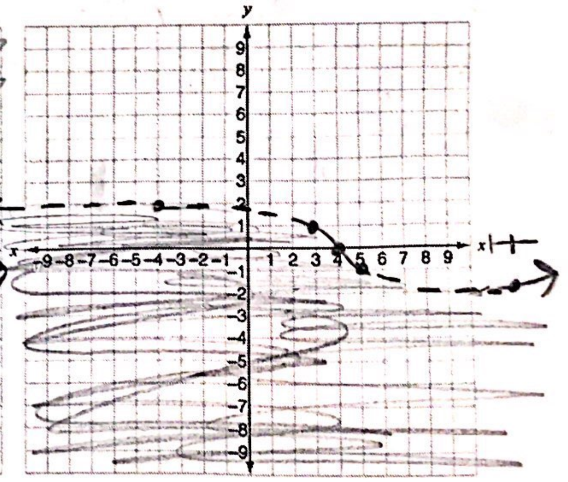
- left 1
- reflect over x axis
- vertical shrink by 1/3



6) $y < \sqrt[3]{-x + 4}$ $\sqrt[3]{-1(x-4)}$

-x+4	y
12	-2
5	-1
4	0
3	1
-4	2

- reflect over y-axis
- right 4



$8 = (-56 + 15(8))^{1/2}$
$8 = 8$ $\quad 7 = (-56+15(7))^{1/2}$
$7 = 7$

Solve each equation or inequality. Remember to check for extraneous solutions.

7) $\left(3\sqrt[3]{x+4}\right)^3 = \left(\sqrt[3]{-1-4x}\right)^3$

$27(x+4) = -1-4x$
$27x+108 = -1-4x$
$31x+108 = -1$
$31x = -109$
$x = \frac{-109}{31}$

8) $x = (-56+15x)^{\frac{1}{2}}$

$(x)^2 = \left(\sqrt{-56+15x}\right)^2$
$x^2 = -56+15x$
$x^2-15x+56 = 0$
$(x-7)(x-8) = 0$
$x=7$ $\quad x=8$

9) $r = -1+\sqrt{7r+15}$

$(r+1)^2 = \left(\sqrt{7r+15}\right)^2$ $\quad r=7$ $\quad \cancel{r=-2}$
$r^2+2r+1 = 7r+15$
$r^2-5r-14 = 0$
$(r-7)(r+2) = 0$
$7 = -1+\sqrt{7(7)+15}$ $\quad -2 = -1+\sqrt{7(-2)+15}$
$7 = -1+\sqrt{49+15}$ $\quad -2 = -1+\sqrt{1}$
$7 = -1+8$ $\quad 7=7$ ✓ $\quad -2 = -1+1$
$-2 \neq 0$

10) $8 = (m-7)^{\frac{1}{2}}+7$

$1 = (m-7)^{1/2}$
$1 = m-7$
$8 = m$

11) $-2\sqrt{x+3} \geq 6$
$\div -2 \quad \div -2$

$\sqrt{x+3} \leq -3$
no solution
the square root can not be negative

12) $\sqrt{3x+6} \leq 3$

$3x+6 \leq 9$ $\quad 3x+6 \geq 0$
$3x \leq 3$ $\quad 3x \geq -6$
$x \leq 1$ $\quad x \geq -2$
$-2 \leq x \leq 1$

13) $\frac{1}{4}\sqrt{2x-8}+5 > 13$ $\quad 2x-8 \geq 0$
$2x \geq 8$
$x \geq 4$

$\frac{1}{4}\sqrt{2x-8} > 8$
$\sqrt{2x-8} > 32$
$2x-8 > 1024$
$2x > 1032$
$x > 516$
$x > 516$

14) $\sqrt[3]{3x}-6 \leq 9$

$\left(\sqrt[3]{3x}\right)^3 \leq (15)^3$
$3x \leq 3375$
$x \leq 1125$

15) $3(5x+1)^{\frac{1}{4}} = 6$

$\left((5x+1)^{\frac{1}{4}}\right)^4 = (2)^4$ $\quad 3(16)^{1/4} = 6$
$5x+1 = 16$ $\quad 3 \cdot 2$
$5x = 15$ $\quad 6 = 6$
$x = 3$

16) $\left(\sqrt{-14x+2}\right)^2 = (x-3)^2$

$-14x+2 = x^2-6x+9$
$= x^2+8x+7$
$= (x+7)(x+1)$

$\cancel{x=-7}$ $\quad \cancel{x=-1}$
$\sqrt{-14(-7)+2} = -7-3$ $\quad \sqrt{-14(-1)+2} = -1-3$
$\sqrt{100} = -10$ $\quad \sqrt{16} = -4$
$10 \neq -10$ $\quad 4 \neq -4$
no solution

17) $v = \sqrt{-1-2v}$

$v^2 = -1-2v$
$v^2+2v+1 = 0$
$(v+1)(v+1) = 0$
$\cancel{v=-1}$
$-1 = \sqrt{-1-2(-1)}$
$-1 = \sqrt{-1+2}$
$-1 \neq 1$
no solution

18) $v = \sqrt{5v}$

$v^2 = 5v$
$v^2-5v = 0$
$v(v-5) = 0$
$v=0$ $\quad v=5$
$0 = \sqrt{5(0)}$ $\quad 5 = \sqrt{5(5)}$
$0 = 0$ $\quad 5 = \sqrt{25}$
$5 = 5$

19) $-3\sqrt{2x-1} = 4\sqrt{x-4}$ $\quad -3\sqrt{-55-1} = 4\sqrt{\frac{-55}{2}-4}$
$-3\sqrt{-56}$

$9(2x-1) = 16(x-4)$
$18x-9 = 16x-64$
$2x-9 = -64$
$2x = -55$
$\cancel{x = \frac{-55}{2}}$
no solution

Write the radical function given the following transformations.

20) The parent function $f(x) = \sqrt{x}$ vertically compressed by 1/3, translated left 4, and up 2.

$f(x) = \frac{1}{3}\sqrt{x+4} + 2$

21) The parent function $f(x) = \sqrt[3]{x}$ reflected across the x-axis, horizontally stretched by 4, and shifted down 1.

$f(x) = -\sqrt[3]{\frac{1}{4}x} - 1$

22) The parent function $f(x) = \sqrt{x}$ reflected over the y-axis, horizontally compressed by ½, and shifted right 3.

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

Solve for the specified variable.

23) $A = \frac{1}{2}h(b_1 + b_2), \ for\ b_2$

$\frac{2A}{h} = \frac{h(b_1+b_2)}{h}$

$\frac{2A}{h} = b_1 + b_2$

$\boxed{\frac{2A}{h} - b_1 = b_2}$

24) $SA = \frac{1}{3}\pi r^2 h, \ for\ h.$

$3SA = \frac{\pi r^2 h}{\pi r^2}$

$\frac{3SA}{\pi r^2} = h$

25) . A biologist is studying two species of animals in a habitat. The population, p_1, of one of the species is growing according to $p_1 = 500t^{\frac{3}{2}}$ and the population, p_2, of the other species is growing according to $p_2 = 100t^2$ where time, t, is measured in years. After how many years will the populations of the two species be equal?

$62{,}500 = 500(25)^{3/2}$

$62{,}500 = 500(\sqrt{25})^3$

$62{,}500 = (500)(125)$

$62{,}500 = 62{,}500$

$p_1 = 500t^{3/2}$ $\quad$ $p_2 = 100t^2$

$\frac{100t^2}{100} = \frac{500t^{3/2}}{100}$

$t^2 = 5t^{3/2}$

$t^2 - 5t^{2/2}t^{1/2} = 0$

$t(t - 5t^{1/2}) = 0$

$t = 0$ or $t - 5t^{1/2} = 0$

$t = 5t^{1/2}$

$(t)^2 = (5\sqrt{t})^2$

$t^2 = 25t$

$t^2 - 25t = 0$

$t(t-25) = 0$

$t = 0 \quad t = 25$

At 25 years the population of the 2 species are equal

$(S)^2 = (\sqrt{30fd})^2$

$S^2 = 30fd \quad \frac{S^2}{30f} = d$

26) **The formula $s = \sqrt{30fd}$ can be used to estimate the speed, s, in miles per hour that a car is traveling when it goes into a skid, where f is the coefficient of friction and d is the length of the skid marks in feet.**

~~1. How does the speed vary as the length of the skid marks?~~ ______

2. Kody skids to a stop on a street with a speed limit of 35 mi/h. His skid marks measure 52 ft, and the coefficient of friction is 0.7. Kody says that he was driving only about 30 mi/h. Kody wants to prove that he was not speeding. $= 52$

a. Solve the equation for d in terms of s. $d = \frac{s^2}{30f}$

b. How long would the skid marks be if he had been driving at a speed of 35 mi/h? $58.\overline{3}$ feet

$35 = \sqrt{30(.7)d}$

$35 = \sqrt{21d}$

c. Was Kody speeding or not? Explain how you know.

$\frac{1{,}225}{21} = \frac{21d}{21}$

$58.\overline{3} = d$

d. Find his actual speed. 33 mi/h

$S = \sqrt{30(.7)(52)}$

$S = \sqrt{1092}$

$S = 33.05$

27) The radius r in feet of a spherical water tank can be determined by using the formula $r = \sqrt[3]{\frac{3V}{4\pi}}$, where V is the volume of the tank in cubic feet. To the nearest cubic foot, what is the volume of a spherical tank with a radius of 32 ft?

$r = \sqrt[3]{\frac{3V}{4\pi}}$

$(32)^3 = \left(\sqrt[3]{\frac{3V}{4\pi}}\right)^3$

$32{,}768 = \frac{3r}{4\pi}$

$4\pi(32{,}768) = 3r$

$131{,}072\pi = 3r$

$43690.7\pi = r$

$137{,}258 = r$

137,258 ft

ⓒ
27) Kody was not speeding since the actual skid mark length is shorter than the predicted skid mark length.