2.2 # 6 $\qquad$ $f(x) + h$

2.1 # 29 $\qquad$ $f(x+h)$

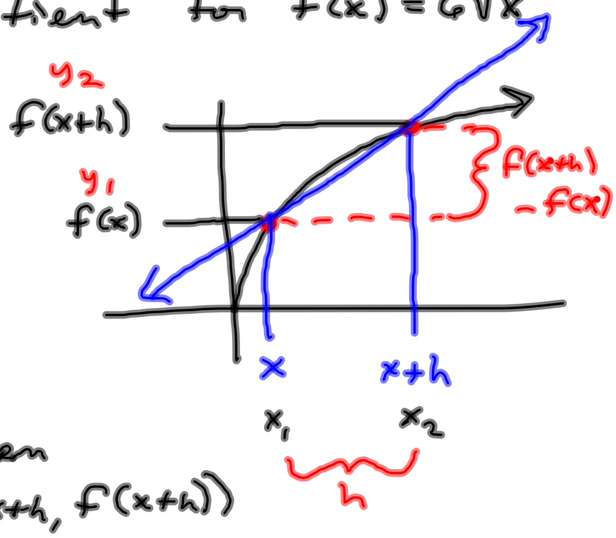
Find the difference quotient for $f(x) = 6\sqrt{x}$

Praxis

$f(1) = 6\sqrt{1} = 6$

$f(☺) = 6\sqrt{☺}$

The blue line has slope that's the average slope for $f(x) = 6\sqrt{x}$ between $(x, f(x))$ and $(x+h, f(x+h))$



h

m_{sec} = slope of secant line = difference quotient.

$$= \frac{y_2-y_1}{x_2-x_1} = \frac{\Delta y}{\Delta x} = \frac{f(x+h)-f(x)}{h} = \frac{6\sqrt{x+h}-6\sqrt{x}}{h}$$

$$x_2-x_1 = x+h-x = h$$

$$= \left(\frac{6\sqrt{x+h}-6\sqrt{x}}{h}\right)\left(\frac{6\sqrt{x+h}+6\sqrt{x}}{6\sqrt{x+h}+6\sqrt{x}}\right) = \frac{(6\sqrt{x+h})^2-(6\sqrt{x})^2}{h(6\sqrt{x+h}+6\sqrt{x})}$$

$$(a-b)(a+b) = a^2-b^2$$

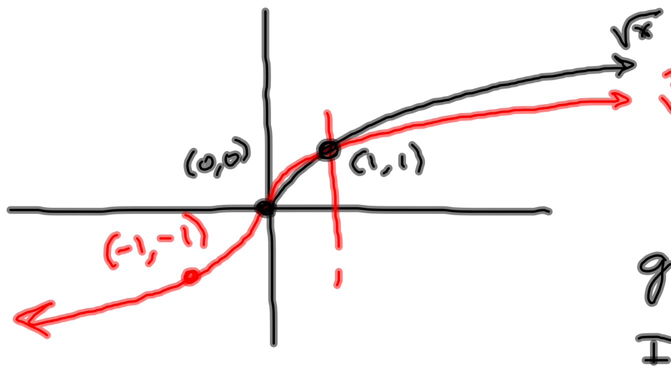
$$(1-\sqrt{2})(1+\sqrt{2}) = 1^2-(\sqrt{2})^2 = 1-2 = -1$$

$$= \frac{6^2(\sqrt{x+h})^2-6^2(\sqrt{x})^2}{6h(\sqrt{x+h}+\sqrt{x})} = \frac{36(x+h)-36x}{6h(\sqrt{x+h}+\sqrt{x})}$$

$$= \frac{36x+36h-36x}{6h(\sqrt{x+h}+\sqrt{x})} = \frac{\overset{6}{36}\cancel{h}}{\underset{1}{6}\cancel{h}(\sqrt{x+h}+\sqrt{x})}$$

$$= \boxed{\frac{6}{\sqrt{x+h}+\sqrt{x}}} \xrightarrow[h\to 0]{\text{In Calc I}} \frac{6}{2\sqrt{x}} = \frac{3}{\sqrt{x}}$$

Final Answer for College Algebra.



$\sqrt[3]{x}$ has $\mathcal{D} = \mathbb{R}$

graph $\sqrt[3]{x} - 7$

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

$y = \sqrt[3]{x} - 7 = f(x) - 7$

Down 7

§ 2.3 KNOW the basic functions.

$f(x) = x, |x|, x^2 (x^4, x^6, \dots), x^3 (x^5, x^7, x^9, \dots),$

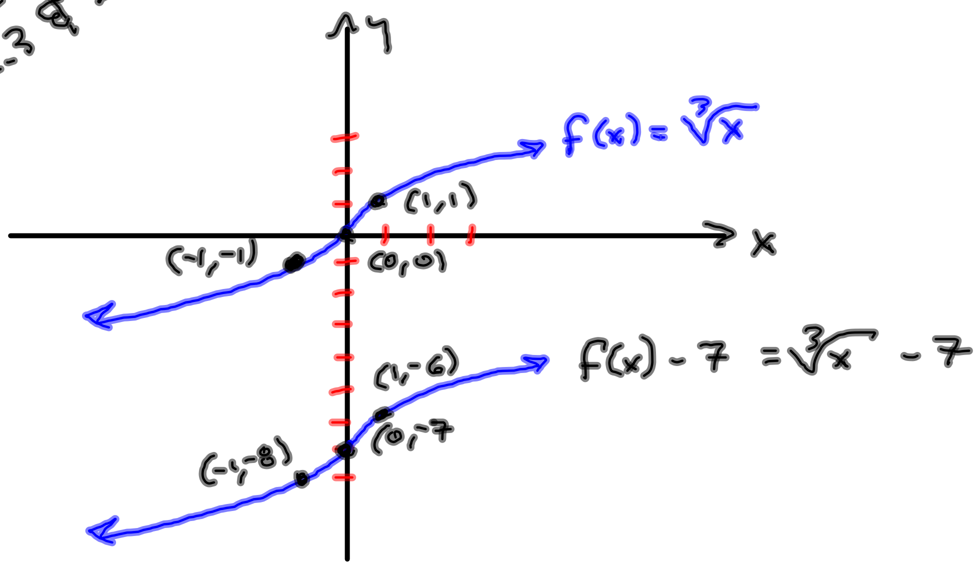
$\frac{1}{x}, \frac{1}{x^2}, \sqrt{x}, \sqrt[3]{x}$.

x	$\sqrt[3]{x} - 7$
-3	$\sqrt[3]{-3} - 7$
-2	$\sqrt[3]{-2} - 7$
-1	$\sqrt[3]{-1} - 7$
0	$\sqrt[3]{0} - 7$
1	$\sqrt[3]{1} - 7$
2	$\sqrt[3]{2} - 7$
3	$\sqrt[3]{3} - 7$

The points I care about.

$\sqrt[3]{x} - 7$

I did this §2.2 #6 with 2.3 & 2.4 thrown in.

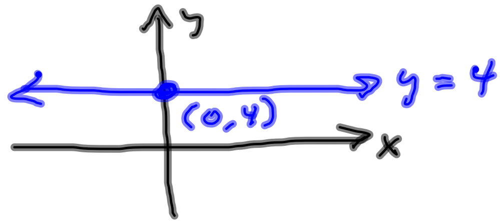


Give $\mathcal{D}$ & $\mathcal{R}$

$\mathcal{D} = \{ x \mid f(x) \text{ is real} \}$

$\mathcal{R} = \{ y \mid y = f(x) \text{ for some } x \in \mathcal{D} \}$

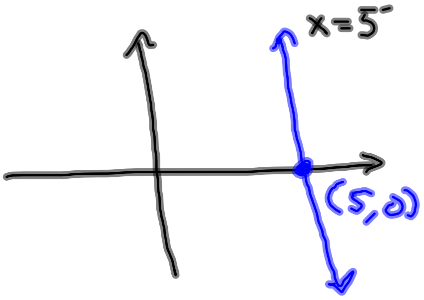
$\{ (x, y) \mid y = 4 \}$

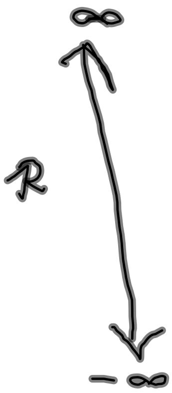


$\mathcal{D} = \mathbb{R}$

$\mathcal{R} = \{ 4 \}$

$\{ (x, y) \mid x = 5 \}$





$\mathcal{D} = \{ 5 \}$

$\mathcal{R} = (-\infty, \infty) = \mathbb{R}$

Is this a function?

No. $\boxed{\text{One y-value per x-value only.}}$ → Function

x=5 is paired with every real number.

→ Relation is the more general term.

$\{ (x, y) \mid x = 5 \}$ is a relation, but not a function.

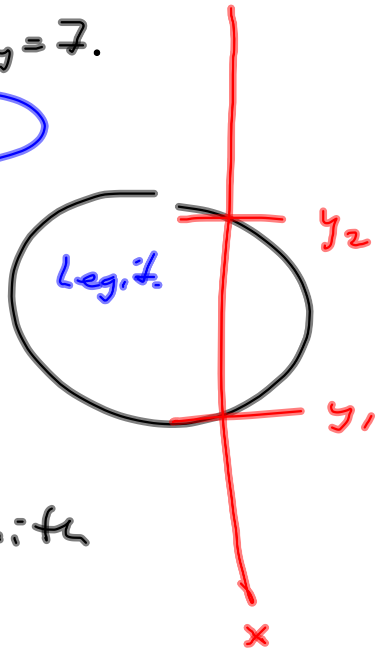
$\{(1,2),(3,7),(5,6)\}$ is func.

$\{(1,2),(1,7),(5,6)\}$ is not func.

$x=1$ is paired with $y=2$, $y=7$.

Is $y=3x+1$ a func? Yes

x	y
-1	$3(-1)+1=-2$



$$x^2+y^2=16$$

is not a function, because ....

Find one x-value that goes with more than one y-value.

$x=1$?

$$1^2+y^2=16$$
$$y^2=15$$
$$y=\pm\sqrt{15}$$

Shows that $(1,-\sqrt{15})$ & $(1,\sqrt{15})$ are in the relation.

Difference Quotient:

for $f(x) = 3x + 2$

$$\frac{f(x+h) - f(x)}{h} = \frac{3(x+h) + 2 - (3x+2)}{h}$$

$$= \frac{3x + 3h + 2 - 3x - 2}{h} = \frac{3\cancel{h}}{\cancel{h}} = \boxed{3}$$

$f(x) = x^2$

$$f(\boxed{}) = \boxed{}^2$$

$$f(x+h) = (x+h)^2$$

$$f(\boxed{x+h}) = \boxed{x+h}^2$$

$$\frac{f(x+h) - f(x)}{h} = \frac{(x+h)^2 - x^2}{h}$$

$$= \frac{x^2 + 2xh + h^2 - x^2}{h} = \frac{2xh + h^2}{h} = \frac{\cancel{h}(2x+h)}{\cancel{h}} = 2x+h$$

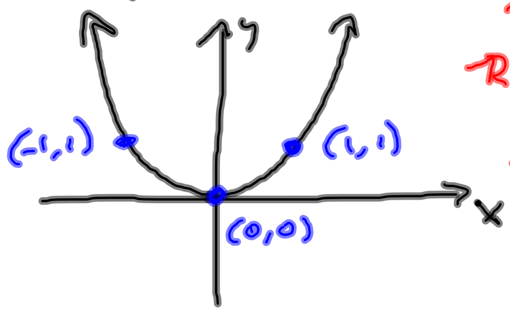
$(x+h)^2 = x^2 + 2xh + h^2$

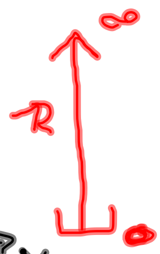
Get it!

$(x+h)(x+h) = x^2 + xh + hx + h^2 = x^2 + 2xh + h^2$

Basic Functions What I need to see.

$f(x) = x^2$



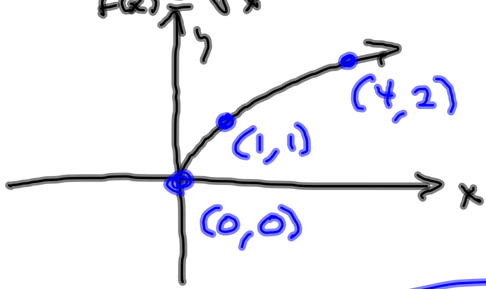


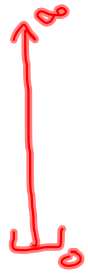
$x^2 + 7x - 11$

$\mathcal{D} = \mathbb{R} = (-\infty, \infty)$

$\mathcal{R} = [0, \infty)$

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





$\mathcal{D} = [0, \infty)$

$\mathcal{R} = [0, \infty)$

$\sqrt{x-7}$

Right 7

"Delay"