§2.1 #s 35-41

Does equation define y as a function of x?
Can you solve for y & get one expression out?
"$\pm$ expression is two expressions"

y^2 is bad sign
y^3 = stuff has only one real solution.

$y^2 = \boxed{\text{something} \geq 0}$

$y = \pm\sqrt{\text{something}}$

y^3 = blah has 3 solutions. one real and two nonreal

$y^3 = \text{something}$

$y = \sqrt[3]{\text{something}}$

y^2 = blah has 2 solutions. Both real if one of 'em is.

$y^2 = \text{negative}$
No real solutions

$y^3 = \text{negative}$

$y = \sqrt[3]{\text{negative}}$ is real.

36 $y^2 - x^2 = 9$

$y^2 = x^2 + 9$

$\sqrt{y^2} = \sqrt{x^2 + 9}$

$|y| = \sqrt{x^2+9}$

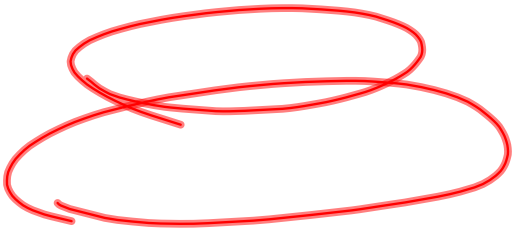
$y = \pm\sqrt{x^2+9}$

$|A| = B \Longrightarrow$

$A = \pm B$

$|A| = 3 \Longrightarrow$

$A = \pm 3$



41 $x = |2y|$

$$\boxed{\begin{aligned} |2y| &= x \\ 2y &= \pm x \end{aligned}}$$

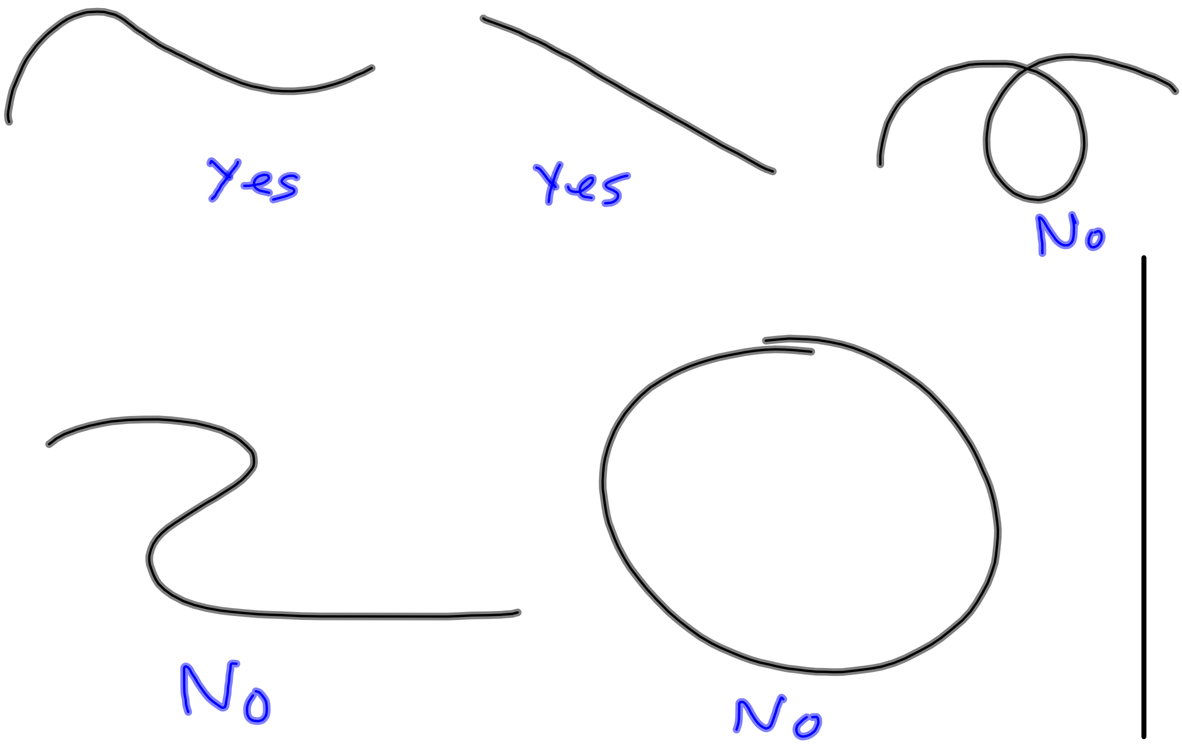
$y = \dfrac{\pm x}{2}$

MIRV-No!

$x = 1$ — 1 input x

$\left.\begin{array}{l} y = 1/2 \\ \text{OR} \\ y = -1/2 \end{array}\right\}$ 2 outputs y

So y isn't a function of x.



circles

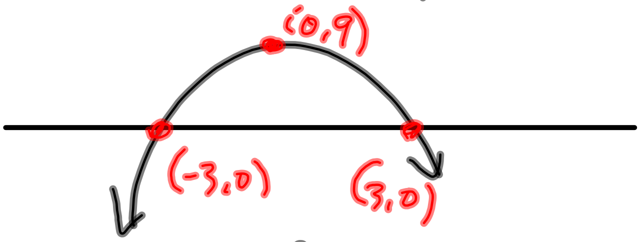
$$x^2 + y^2 = 9$$

$y^2 = 9 - x^2$

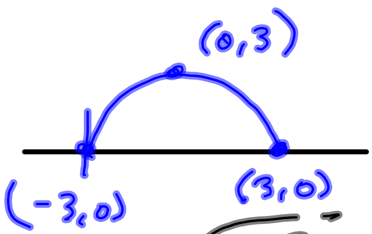
$y = \pm\sqrt{9-x^2}$ → $+\sqrt{9-x^2}$ Top half. → $-\sqrt{9-x^2}$ Bottom half.

$y = \sqrt{9-x^2} = \sqrt{(3-x)(3+x)}$

$y = 9 - x^2 = (3-x)(3+x)$ has x-intercepts



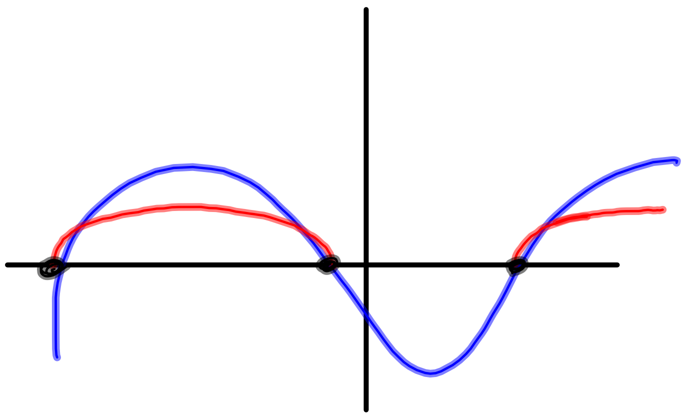
$y = 9 - x^2$



$y = \sqrt{9-x^2}$

$y^2 = 9 - x^2$

$y = f(x)$



$y = \sqrt{f(x)}$
in red

Does equation define y as a function of x? If not, why not?

$$x^2+y^2=9$$
$$y^2 = 9-x^2$$
$$y=\pm\sqrt{9-x^2} \Longrightarrow$$

$x=1$: $\sqrt{9-1} = \sqrt{8}$
$-\sqrt{9-1} = -\sqrt{8}$
shows that there are two values corresponding to $x=1$.

The $\boxed{\text{relation}}$ has $(1,\sqrt{8})$ & $(1,-\sqrt{8})$ among its members

Collection of ordered pairs.

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

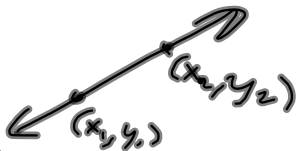
$\mathcal{R}$ = Range = $\{y \mid y=f(x) \text{ for some } x\in\mathcal{D}\}$

$\{(1,2),(3,-5),(7,11),(24,7),(3,2)\}$
Is a relation.

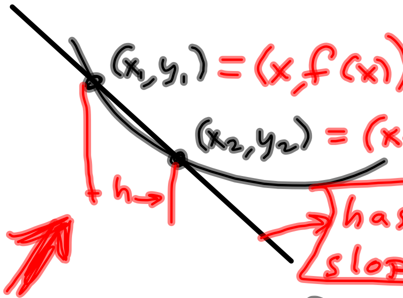
$\mathcal{D}=\{1,3,7,24,3\} = \{1,3,7,24\}$

$\mathcal{R}=\{2,-5,11,7,2\}=\{2,-5,11,7\}$

$$\text{Slope} = \frac{y_2 - y_1}{x_2 - x_1}$$



Average Slope of a curve $y = f(x)$



$y = f(x)$

$x + h - x = h$

has average slope of $f(x)$ on $[x_1, x_2]$

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

Re-label: Let $x = x_1$

Define $h = x_2 - x_1$

Then $x_2 - x_1 = h$

$x_2 = x_1 + h$

$x_2 = x + h$

#s 83-98 Find the difference quotient

$$\boxed{\frac{f(x+h)-f(x)}{h}}$$

for the given f(x) and simplify.

§2.1

87 $\quad y = x^2 + x = f(x) \Longrightarrow \dfrac{f(x+h)-f(x)}{h}$

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

f(☺) = ☺^{2} + ☺

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

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

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

$(x+h)(x+h)$

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

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

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

$f\,(x+h)$

$f(x) + h$

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

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

$$= \frac{2xh + h^2 + h}{h}$$

$$= \frac{(2x+h+1)h}{h} = \boxed{2x+h+1}$$

What's the average rate of change in $f(x)$ over $[2, 2.1]$?

$$\frac{f(x_2)-f(x_1)}{x_2-x_1} = \frac{f(x+h)-f(x)}{h}$$, where $x=2$, $h=.1$

where $x_1 = 2$, $x_2 = 2.1$

$x_2 = 2.1$

We did the legwork above

$2(2) + .1 + 1$

$\boxed{= 5.1}$

Sep 4-9:01 AM