

MTH-PC College Algebra Session 19 11/14

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

Average Rate = slope

Average Rate

$$x_1 = 1 \quad x_2 = 4$$

$$y = f(x)$$

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

$$\frac{f(x_2) - f(x_1)}{x_2 - x_1}$$

$$\frac{f(4) - f(1)}{4 - 1}$$

$$f(x) \Rightarrow \frac{(4)^2 + 2(4) - (1^2 + 2(1))}{4 - 1}$$

$$\frac{16 + 8 - (1 + 2)}{3} = \frac{24 - 3}{3} = \frac{21}{3} = 7$$

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

difference quotient

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

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

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

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

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

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

$$\begin{matrix} \curvearrowright & \textcircled{2} & -1 & \curvearrowright & & \\ & X & + & 2X & & \\ & & & & & -1 \end{matrix}$$

$$\boxed{2x + 2} \quad (+3)$$

$$\boxed{f(x) = 3x + x^2}$$

$x_1 = \underline{2}$ $x_2 = \underline{\underline{5}}$

Average Rate of Change

$$\frac{f(x_2) - f(x_1)}{x_2 - x_1}$$

$$\frac{f(5) - f(2)}{5 - 2}$$

$$\frac{\overbrace{3(5) + (5)^2}^{f(5)} - (3(2) + (2)^2)}{5 - 2}$$

$$\frac{15 + 25 - (6 + 4)}{3}$$

$$\frac{40 - 10}{3} = \frac{30}{3} = \boxed{10}$$

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

Difference Quotient

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

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

$$\frac{\cancel{3x} + 3h + \cancel{x^2} + h^2 + 2xh - \cancel{3x} - \cancel{x^2}}{h}$$

optional

$$\frac{3x + x^2}{3 + 2x}$$

Diagram showing the simplification of the difference quotient for $f(x) = 3x + x^2$. The expression $3x + x^2$ is shown with arrows indicating the derivative of each term: $\downarrow 3$ and $\downarrow 2x$. Below it, the simplified result $3 + 2x$ is circled. To the right, a box contains the expression $3 + h + 2x$, with arrows pointing down to the 3 and $2x$ terms, indicating the next step in the simplification process.

$$f(x) = \frac{2}{x}$$

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

$$\frac{\frac{2}{x+h} - \frac{2}{x}}{h}$$

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

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

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

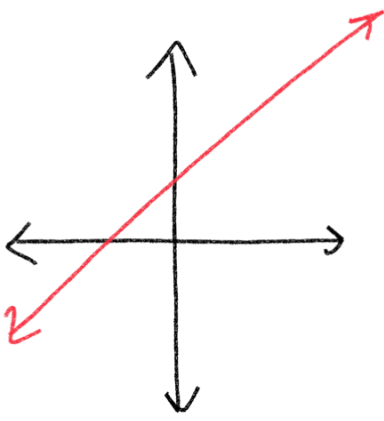
Keep, Change, Flip

$$\frac{-2h}{x(x+h)h} \left\} \frac{-2h}{x(x+h)} \div \frac{h}{1}\right.$$

$$\frac{2}{x} = 2x^{-1-1} = 2x^{-2} = \frac{-2}{x^2}$$

$$\frac{-2h}{x(x+h)h} * \frac{1}{h}$$

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



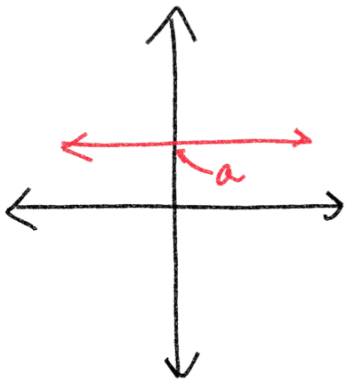
Function: $y = mx + b$

Name: Linear

Domain: $\mathbb{R} (-\infty, \infty)$

Range: $\mathbb{R} (-\infty, \infty)$

Even/odd/neither



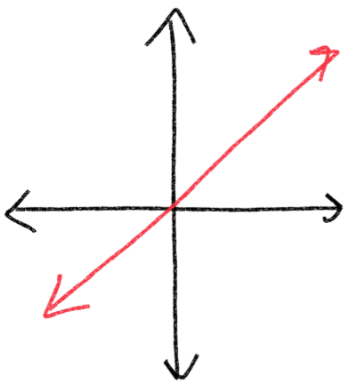
Function: $f(x) = a$

Name: Constant

Domain: $\mathbb{R} (-\infty, \infty)$

Range: a

Even/odd/neither



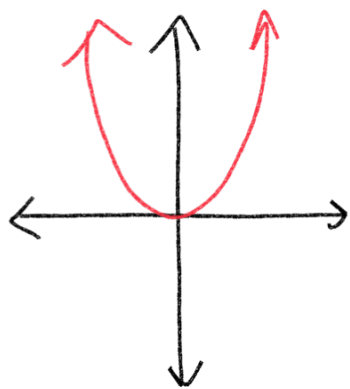
Function: $y = x$ $f(x) = x$

Name: Identity

Domain: $\mathbb{R} (-\infty, \infty)$

Range: $\mathbb{R} (-\infty, \infty)$

Even/odd/neither



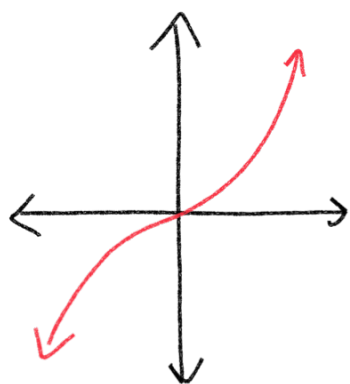
Function: $f(x) = x^2$

Name: Square

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

Range: $[0, \infty)$

Even/odd/neither



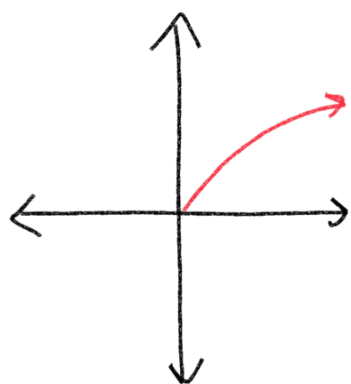
Function: $f(x) = x^3$

Name: Cube

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

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

Even/odd/neither



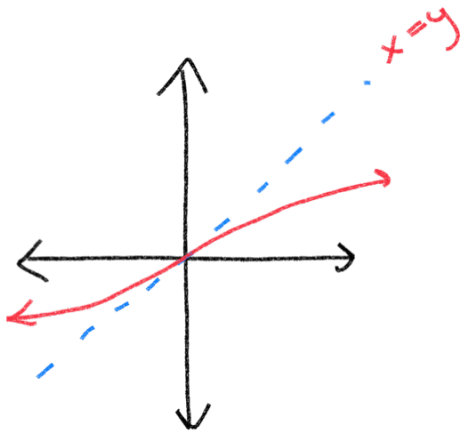
Function: $f(x) = \sqrt{x}$

Name: Square Root

Domain: $[0, \infty)$

Range: $[0, \infty)$

Even/odd/neither



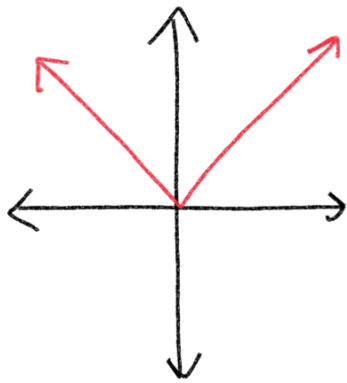
Function: $f(x) = \sqrt[3]{x}$

Name: Cube Root

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

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

Even/odd/neither



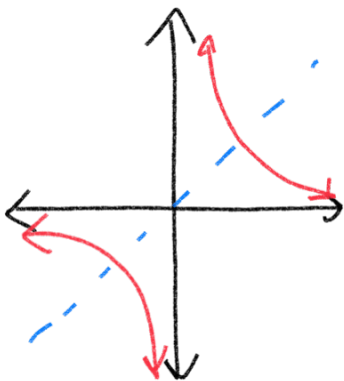
Function: $f(x) = |x|$

Name: Absolute value

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

Range: $[0, \infty)$

Even/odd/neither



Function: $f(x) = \frac{1}{x}$

Name: Inverse (Reciprocal)

Domain: $x \neq 0$ $(-\infty, 0) \cup (0, \infty)$

Range: $y \neq 0$ $(-\infty, 0) \cup (0, \infty)$

Even/odd/neither