

1. Match the function with its type by drawing a line between the function and its type.

$$3x^5 - x^2 + 7$$

algebraic function

$$5^x$$

rational function

$$\frac{2x^2 - 5}{x^{10} - 9x + 7}$$

polynomial function

$$\frac{\sqrt{x^2 - 5}}{1 - \sqrt[3]{x}}$$

exponential function

2. Let $f(x) = \sqrt{x+1}$, $g(x) = \frac{1}{x}$.

- (a) Find $g(x)(f(x)^2 - 1)$ and state its domain using interval notation.

$$\frac{1}{x}(\sqrt{x+1}^2 - 1) = \frac{1}{x}(x+1-1) = \frac{1}{x}(x) = 1 \quad \text{For } x \in [-1, +\infty)$$

$$\begin{aligned} x+1 &\geq 0 \\ \Rightarrow x &\geq -1 \end{aligned}$$

$$\text{DOMAIN} = [-1, +\infty)$$

- (b) Find $(g \circ f)(x)$ and state its domain using interval notation.

$$(g \circ f)(x) = g(\sqrt{x+1}) = \frac{1}{\sqrt{x+1}}, \quad x+1 > 0 \Rightarrow x > -1$$

$$\text{DOM}(g \circ f) = (-1, +\infty)$$

3. State the transformations to the graph of $f(x)$ given by $-2f(x+1) + 4$.

GRAPH OF f IS: REFLECTED ABOUT X-AXIS.
 SCALED VERT. BY A FACTOR OF 2.
 SHIFTED LEFT 1 UNIT.
 SHIFTED UP 4 UNITS.

4. Suppose the graph of $y = f(x) = Ca^x$ passes through the points $(2, 0.75)$ and $(-1, 6)$. Find a formula for $f(x)$. Hint: Substitute the given coordinate pairs in for x and y and solve the resulting system of two equations in " a " and " C ".

$$\begin{aligned} 6 &= Ca^{-1} \\ 0.75 &= Ca^2 \end{aligned} \Rightarrow \frac{6}{0.75} = \frac{Ca^{-1}}{Ca^2} \quad \text{OR} \quad 8 = a^{-3} \Rightarrow a^3 = \frac{1}{8} \Rightarrow \boxed{a = \frac{1}{2}}$$

$$6 = C \cdot \left(\frac{1}{2}\right)^{-1} \Rightarrow 6 = 2C \Rightarrow \boxed{C = 3}$$

$$\boxed{f(x) = 3 \cdot \left(\frac{1}{2}\right)^x}$$

Please present your work in a clear, neat and organized fashion.

1. A ball is thrown into the air by a baby alien on a planet in the system of Alpha Centauri with a velocity of 20 ft/s. Its height in feet after t seconds is given by $y = 20t - 12t^2$. Find the average velocity for the time period beginning when $t_0 = 3$ seconds and lasting 0.01 seconds.

$$V_{\text{AVE}} = \frac{\Delta d}{\Delta t} = \frac{[20(3.01) - 12(3.01)^2] - [20(3) - 12(3)^2]}{0.01} = \frac{-48.5212 - (-48)}{0.01}$$

$$= \frac{-0.5212}{0.01} = -52.12 \text{ ft/sec}$$

2. The point $P(4, 4)$ lies on the curve $y = \sqrt{x} + 2$. Let Q be the point $(x, \sqrt{x} + 2)$. Find the slope of the secant line PQ for $x = 3.9$.

$$P(4, 4), \quad Q(3.9, 3.9748)$$

$$m_{PQ} = \frac{0.02516}{0.1} = \boxed{0.2516}$$

3. Evaluate $\lim_{x \rightarrow 8^-} \frac{x-10}{x^3(x-8)}$. Write ∞ , $-\infty$ or "DNE" as appropriate.

$$\begin{array}{l} \text{As } x \rightarrow 8^-, \quad x-10 \rightarrow -2 \\ \quad \quad \quad x^3 \rightarrow 8^3 \\ \quad \quad \quad x-8 \rightarrow 0^- \end{array} \quad \text{So} \quad \begin{array}{l} \text{NUM} \rightarrow -2 \\ \text{DENOM} \rightarrow 0^- \end{array} \Rightarrow \frac{x-10}{x^3(x-8)} \rightarrow \boxed{+\infty}$$

4. Let f be the function defined by:

$$f(x) = \begin{cases} -2x + 1 & \text{if } x < 1, \\ 2 & \text{if } x = 1, \\ (x-1)^2 - 1 & \text{if } x > 1. \end{cases}$$

- (a) Find $f(1)$

$$\boxed{f(1) = 2}$$

- (b) Find $\lim_{x \rightarrow 1} f(x)$. Write "DNE" if the limit does not exist.

$$\begin{array}{l} \text{As } x \rightarrow 1^-, \quad f(x) = -2x + 1 \rightarrow -1 \\ \quad \quad \quad x \rightarrow 1^+, \quad f(x) = (x-1)^2 - 1 \rightarrow -1 \end{array}$$

THEREFORE

$$\boxed{\lim_{x \rightarrow 1} f(x) = -1}$$