Calculus 1: Tutorial 1

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1.

(a) -2

(b) 2.8

(c) x=-3,1

(d) -2.5,0.3

(e)

$$D_f = [-3, 3]$$
$$R_f = [-2, 3]$$

(f) $(-1, 0.5)$

2.

(a)

$$f(-4) = -2$$
$$g(3) = 4$$

(b)

$$x = -2, 2$$

(c)

$$x = -3, 4$$

(d)

$$(0, 4]$$

(e)

$$D_f = [-4, 4]$$
$$R_f = [-1, 3]$$

(f)

$$D_g = [-4, 4]$$
$$R_f = [-2, 3]$$

3.

(a) Yes.
   i. $D_f = [-3, 2]$
   ii. $R_f = [-2, 2]$
(b) No.
(c) No.
(d) Yes
   i. $D_f = [-2, 2]$
   ii. $R_f = $ (0,3]+$\{-2\}$

4.

$$
\begin{aligned}
f(x) &= 3x^2 - x + 2 \\
f(2) &= 3(2)^2 - (2) + 2 \\
&= 12 \\
f(-2) &= 3(-2)^2 - (-2) + 2 \\
&= 12 + 4 \\
&= 16 \\
f(a) &= 3(a)^2 - (a) + 2 \\
&= 3a^2 - a + 2 \\
f(-a) &= 3(-a)^2 - (-a) + 2 \\
&= 3a^2 + a + 2 \\
f(a+1) &= 3(a+1)^2 - (a+1) + 2 \\
&= 3\left(a^2 + 2a + 1\right) - a - 1 + 2 \\
&= 3a^2 + 6a + 3 - a + 1 \\
&= 3a^2 + 5a + 4 \\
2f(a) &= 2\left(3a^2 - a + 2\right) \\
&= 6a^2 - 2a + 4 \\
f(2a) &= 3(2a)^2 - (2a) + 2 \\
&= 12a^2 - 2a + 2 \\
&= 2\left(6a^2 - a + 1\right) \\
f\left(a^2\right) &= 3\left(a^2\right)^2 - \left(a^2\right) + 2 \\
&= 3a^4 - a^2 + 2 \\
[f(a)]^2 &= \left(3a^2 - a + 2\right)^2 \\
f(a+h) &= 3(a+h)^2 - (a+h) + 2 \\
&= 3(a+h)^2 - a - h + 2
\end{aligned}
$$

5.

(a)

i. The denominator $\neq$0

$$\begin{aligned} 3x - 1 &\neq 0 \\ x &\neq \frac{1}{3} \end{aligned}$$

ii. $D_f = \mathbb{R} - \left\{\frac{1}{3}\right\}$

(b)

i. The denominator $\neq 0$

$$\begin{aligned} x^2 + 3x + 1 \neq 0 \\ x = &\frac{-3+\sqrt{5}}{2}, x = \frac{-3-\sqrt{5}}{2} \end{aligned}$$

ii. $D_f \epsilon \mathbb{R} - \left\{\frac{-3\pm\sqrt{5}}{2}\right\}$

(c)

i. The denonimator $\neq 0$ and the total inside a square root cannot be ≤ 0

$$\begin{aligned} \sqrt[4]{t^2 - 5t} \neq 0 \\ t^2 - 5t > 0 \\ t\,(t-5) > 0 \\ t = &0(ignored), t = 5 \\ t < 0t > 5 \end{aligned}$$

ii. $D_f = t < 0, t > 5$

6.

(a)

$$\begin{aligned} D_f &= -2 \leq x \leq 2 \\ &= [-2, 2] \\ R_f &= [0, 2] \end{aligned}$$

i. Way to solve for the Range
   A. Factorize to find the roots
   B. Solve the inequality and find the required region

ii. Way to sketch the graph
   A. Form the table of equation
   B. Substitute the coordinates of x to find f(x)

C. Plot on the graph and sketch it

D. -Or- Use the d/dx table and d2/dx^2 table

(b)

$$
\begin{aligned}
D_f &= \mathbb{R} - \{2\} \\
R_f &= (-\infty, 2) \cup (2, +\infty)
\end{aligned}
$$

7.