

## Calculus 30 - Unit 2 - Functions

## 2.1 Function Notation p. 55 1-10

1.  $f(x) = x + \frac{2}{x}$

a)  $f(2) = 2 + \frac{2}{2}$   
 $= \textcircled{3}$

b)  $f(-1) = -1 + \frac{2}{-1}$   
 $= \textcircled{-3}$

c)  $f\left(\frac{1}{2}\right) = \frac{1}{2} + \frac{2}{\frac{1}{2}}$   
 $= \frac{1}{2} + 4$   
 $= \textcircled{\frac{9}{2}}$

d)  $f\left(-\frac{2}{3}\right) = -\frac{2}{3} + \frac{2}{-\frac{2}{3}}$   
 $= -\frac{2}{3} + -3$   
 $= \textcircled{-\frac{11}{3}}$

e)  $f(0) = 0 + \frac{2}{0}$   
 $= \textcircled{\text{undefined}}$

f)  $f(\sqrt{2}) = \sqrt{2} + \frac{2}{\sqrt{2}}$   
 $= \sqrt{2} + \frac{2\sqrt{2}}{2}$   
 $= \frac{2\sqrt{2} + 2\sqrt{2}}{2}$   
 $= \frac{4\sqrt{2}}{2} = \textcircled{2\sqrt{2}}$

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

2.  $g(x) = \frac{x^2 - 2x}{x^2 + 2x}$

a)  $g(0) = \frac{0^2 - 2(0)}{0^2 + 2(0)}$   
 $= \frac{0}{0} = \textcircled{\text{indeterminate}}$

b)  $g(-2) = \frac{(-2)^2 - 2(-2)}{(-2)^2 + 2(-2)}$   
 $= \frac{4 + 4}{4 - 4} = \frac{8}{0}$   
 $= \textcircled{\text{fund.}}$

c)  $g(6) = \frac{6^2 - 2(6)}{6^2 + 2(6)}$   
 $= \frac{36 - 12}{36 + 12}$   
 $= \frac{24}{48}$   
 $= \textcircled{\frac{1}{2}}$

d)  $g(2) = \frac{(2)^2 - 2(2)}{(2)^2 + 2(2)}$   
 $= \frac{4 - 4}{4 + 4}$   
 $= \frac{0}{8}$   
 $= \textcircled{0}$

e)  $g(w)$  if  $w \neq (0, -2)$

$$= \frac{w^2 - 2w}{w^2 + 2w}$$
$$= \frac{w(w-2)}{w(w+2)}$$
$$= \boxed{\frac{w-2}{w+2}}$$

f)  $g(-x)$

$$= \frac{(-x)^2 - 2(-x)}{(-x)^2 + 2(-x)}$$
$$= \frac{x^2 + 2x}{x^2 - 2x} \quad \text{OR} \quad \frac{(x+2)}{(x-2)}$$

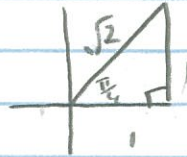
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3.  $h(x) = 4^{\frac{x}{2}} + 2\sin\left(\frac{x}{2}\right)$

a)  $h(\pi) = 4^{\frac{\pi}{2}} + 2\sin\left(\frac{\pi}{2}\right)$   
 $= 4^1 + 2(1)$   
 $= \textcircled{6}$

b)  $h(2\pi) = 4^{\frac{2\pi}{2}} + 2\sin\left(\frac{2\pi}{2}\right)$   
 $= 4^{\frac{2}{1}} + 2\sin \pi$   
 $= 2 + 2(0)$   
 $= \textcircled{2}$

c)  $h\left(\frac{\pi}{2}\right) = 4^{\frac{\frac{\pi}{2}}{2}} + 2\sin\left(\frac{\frac{\pi}{2}}{2}\right)$   
 $= 4^{\frac{1}{2}} + 2\left(\sin \frac{\pi}{4}\right)$   
 $= 16 + 2\left(\frac{\sqrt{2}}{2}\right)$   
 $= \textcircled{16 + \sqrt{2}}$



4.  $f(x) = 2x^2 + 6x - 1$

a)  $f(-5) = 2(-5)^2 + 6(-5) - 1$   
 $= 50 - 30 - 1$   
 $= \textcircled{19}$

b)  $f(3+h) = 2(3+h)^2 + 6(3+h) - 1$   
 $= 2(9 + 6h + h^2) + 18 + 6h - 1$   
 $= 18 + 12h + 2h^2 + 18 + 6h - 1$   
 $= \textcircled{2h^2 + 18h + 35}$

c)  $f(-2x+1) = 2(-2x+1)^2 + 6(-2x+1) - 1$   
 $= 2(4x^2 - 4x + 1) - 12x + 6 - 1$   
 $= 8x^2 - 8x + 2 - 12x + 6 - 1$   
 $= \textcircled{8x^2 - 20x + 7}$

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

$= \frac{2(x+h)^2 + 6(x+h) - 1}{h} - \frac{2x^2 + 6x - 1}{h}$

$= \frac{2(x^2 + 2xh + h^2) + 6x + 6h - 1}{h} - \frac{2x^2 + 6x - 1}{h}$

$= \frac{2x^2 + 4xh + 2h^2 + 6x + 6h - 1 - 2x^2 - 6x + 1}{h}$

$= \frac{2h^2 + 4xh + 6h}{h}$

$= \textcircled{2h + 4x + 6}$

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4 e)  $f(a+h) - f(a-h)$

$$= (2(a+h)^2 + 6(a+h) - 1) - (2(a-h)^2 + 6(a-h) - 1)$$

$$= (2(a^2 + 2ah + h^2) + 6a + 6h - 1) - (2(a^2 - 2ah + h^2) + 6a - 6h - 1)$$

$$= 2a^2 + 4ah + 2h^2 + 6a + 6h - 1 - 2a^2 + 4ah - 2h^2 - 6a + 6h + 1$$

$$= 8ah + 12h$$

5  $j(x) = \frac{1}{x-1}$

a)  $j(\frac{1}{3}) = \frac{1}{\frac{1}{3}-1}$

$$= \frac{1}{-\frac{2}{3}} = \left(\frac{-3}{2}\right)$$

b)  $j(\frac{1}{h}) = \frac{1}{\frac{1}{h}-1}$

$$= \frac{1}{\frac{1-h}{h}} = \left(\frac{h}{1-h}\right) \text{ or } \frac{-h}{h-1}$$

c)  $j(x+2) = \frac{1}{x+2-1}$

$$= \left(\frac{1}{x+1}\right)$$

d)  $j\left(\frac{1}{x+2}\right) = \frac{1}{\frac{1}{x+2}-1}$

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

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

$$= \left(\frac{-(x+2)}{x+1}\right)$$

6 a)  $f(-1) = 2$

b)  $f(3) = -1$

c)  $f(2.5) = -1.5$

d)  $f(0) = 1$

7.  $f(x) = 1$  at  $\{-3, 0, 4\}$

8  $f(x) = -2$  at  $\{2\}$

9  $f(x) = 0$  at  $\{0.5, 3.5\}$

10  $[0, 4]$   $f(x) = -1$  at  $\{1, 3\}$