

# Do Now: #s 1-3

Name: \_\_\_\_\_  
 PCH: SAT-like Function Questions

Date: \_\_\_\_\_

1. Let  $f(x) = 4x - 3$ . If  $f(a) = 9$  and  $f(b) = 5$ , then what is  $f(a+b)$ ?  
 (A) 5 (B) 7 (C) 14 (D) 16 (E) 17

$$\begin{array}{l} f(a) = 4a - 3 \\ 4a - 3 = 9 \\ 4a = 12 \\ a = 3 \end{array} \quad \begin{array}{l} f(b) = 4b - 3 \\ 4b - 3 = 5 \\ 4b = 8 \\ b = 2 \end{array} \quad \begin{array}{l} f(3+2) = f(5) = 4(5) - 3 = 17 \end{array}$$

2. Let  $f(x) = x^2 - 1$ , and  $f(2a) = 35$ , then what could be the value of  $a$ ?  
 (A) -6 (B) -3 (C) 1 (D) 2 (E) 6

$$\begin{array}{l} f(2a) = (2a)^2 - 1 \\ (2a)^2 - 1 = 35 \\ 4a^2 - 1 = 36 \end{array} \quad \begin{array}{l} 4a^2 = 36 \\ a^2 = 9 \\ a = \pm 3 \end{array}$$

$$z(q) = 4q + \frac{1}{2}$$

3. The zoomster function  $z$  used in space flight engineering is defined above. If, for some reason  $u$ ,  $z(u + 1/2) = 1/2$ , then what is the value of  $u$ ?  
 (A)  $-3/2$  (B)  $-1/2$  (C)  $-1/8$  (D)  $1/8$  (E)  $1/2$

$$\begin{array}{l} z(u + \frac{1}{2}) = 4(u + \frac{1}{2}) + \frac{1}{2} \\ 4(u + \frac{1}{2}) + \frac{1}{2} = \frac{1}{2} \\ 4(u + \frac{1}{2}) = 0 \end{array} \quad \begin{array}{l} u + \frac{1}{2} = 0 \\ u = -\frac{1}{2} \end{array}$$

4. For any positive integer  $n$ , let  $n^\diamond$  be defined by  $n^\diamond = 2n(n+1)$ . What is the value of  $\frac{8^\diamond}{2^\diamond}$ ?  
 (A)  $2^\diamond$  (B)  $4^\diamond$  (C)  $6^\diamond$  (D)  $8^\diamond$  (E)  $10^\diamond$

For each function, find  $\frac{f(x+h) - f(x)}{h}$ ,  $h \neq 0$

1.  $f(x) = 5$

constant  
function

$$\frac{5 - 5}{h}$$

$$\frac{0}{h}$$

$$0$$

2.  $f(x) = 3x - 4$

$$\frac{3(x+h) - 4 - (3x - 4)}{h}$$

$$\frac{3x + 3h - 4 - 3x + 4}{h}$$

$$\frac{3h}{h}$$

$$3$$

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

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

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

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

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

$$\frac{h(2x+h+2)}{h} = 2x+h+2 \quad h \neq 0$$

5.  $f(x) = 3x^2 - 4x + 2$

$$\frac{3(x+h)^2 - 4(x+h) + 2 - (3x^2 - 4x + 2)}{h}$$

$$\frac{3(x^2 + 2xh + h^2) - 4x - 4h + 2 - 3x^2 + 4x - 2}{h}$$

$$\frac{\cancel{3x^2} + 6xh + 3h^2 - \cancel{4x} - 4h + 2 - \cancel{3x^2} + \cancel{4x} - 2}{h}$$

$$\frac{6xh + 3h^2 - 4h}{h} = \frac{h(6x + 3h - 4)}{h} \quad h \neq 0$$

$$7. f(x) = \frac{1}{3x}$$

$$\frac{\frac{1}{\cancel{3(x+h)}} \cdot \frac{(3x+3h)(3x)}{(3x+3h)(3x)} - \frac{1}{\cancel{3x}} \cdot \frac{(3x+3h)(3x)}{(3x+3h)(3x)}}{h(3x+3h)(3x)}$$

$$h \neq 0 \\ x \neq -h, 0$$

\* could have used  $3x(x+h)$  \*

our true LCD is  $3x(x+h)$

$$\frac{\frac{1}{3(x+h)} \cdot \frac{3x(x+h)}{3x(x+h)} - \frac{1}{3x} \cdot \frac{3x(x+h)}{3x(x+h)}}{h \cdot 3x(x+h)} \quad \begin{matrix} h \neq 0, -x \\ x \neq 0 \end{matrix}$$

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

$$\frac{-h}{3xh(x+h)} = \frac{-1}{3x(x+h)}$$

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

$$\frac{-3h}{h(3x+3h)(3x)} = \frac{-3}{3x(x+h)} = \frac{-1}{3x(x+h)}$$

$$10. f(x) = \sqrt{x+4}$$

$$\frac{(\sqrt{x+h+4} - \sqrt{x+4}) \cdot (\sqrt{x+h+4} + \sqrt{x+4})}{h(\sqrt{x+h+4} + \sqrt{x+4})}$$

conjugates

$$\frac{x+h+4 - (x+4)}{h(\sqrt{x+h+4} + \sqrt{x+4})}$$

$$\frac{x+h+4 - x - 4}{h(\sqrt{x+h+4} + \sqrt{x+4})} = \frac{h}{h(\sqrt{x+h+4} + \sqrt{x+4})} = \frac{1}{\sqrt{x+h+4} + \sqrt{x+4}}$$

\* not going to require you to write restrictions on the difference quotients that involve radicals \*

**Multiple Choice:**

4. If  $g(x) = ax + b$ , then  $\frac{g(b) - g(a)}{b - a} =$

(A)  $a$       (B)  $b$       (C)  $x$       (D)  $ax$       (E)  $ax + b$

5. If  $f(x) = 5^x$ , then  $\frac{f(a)}{f(b)} =$

(A)  $f(a + b)$       (B)  $f\left(\frac{a}{b}\right)$       (C)  $f(ab)$        (D)  $f(a - b)$

6. If  $g(x) = 3^x$ , then  $g(x + 1) - g(x) =$

(A)  $g(x)$        (B)  $2g(x)$       (C)  $3g(x)$       (D)  $0$

**More Practice:**

**Homework 10-04**

7. Given  $f(x) = -2x^2 - 3x + 1$

(g) Find  $f(2)$ .  $= -13$

(h) Find  $f(2 + h)$   $= -2h^2 - 11h - 13$

$$\begin{aligned} f(2+h) &= -2(2+h)^2 - 3(2+h) + 1 \\ &= -2(h^2 + 4h + 4) - 6 - 3h + 1 \\ &= \underline{\underline{-2h^2}} - 8h - \underline{\underline{8}} - 6 - 3h + \underline{\underline{1}} \end{aligned}$$

(i) Find  $\frac{f(2+h) - f(2)}{h}$

$$-2h - 11$$

(j) Find  $f(x+h)$

$$-2x^2 - 4xh - 2h^2 - 3x - 3h + 1$$

(k) Find  $f(x+h) - f(x)$

$$-4xh - 2h^2 - 3h$$

Difference  
Quotient

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

$$-4x - 2h - 3$$

8. Given  $f(x) = \begin{cases} |1-x| & \text{if } x < -2 \\ 2x-3 & \text{if } -2 \leq x \leq 2 \\ x^2-2 & \text{if } x > 2 \end{cases}$

Find :

(a)  $f(-5) = 6$

(b)  $f(-2) = -7$

(c)  $f(0) = -3$

(d)  $f(2) = 1$

(e)  $f(5) = 23$

**More Multiple Choice Practice**

9. If  $f(x) = 16x^2 - 16x + 4$ , then  $f(.25) = ?$

(A) -6.25

(B) -1

(C) .25

(D) 1

(E) 6.25

10. The function  $f(x)$  has the value 0 if and only if  $x$  is a member of the set  $\{-3, 0, 1\}$ . For what values of  $x$  is  $f(x-3) = 0$ ?

(A)  $\{-3, 0, 1\}$

(B)  $\{0, 1\}$

(C)  $\{0, 3, 4\}$

(D)  $\{-6, 0, 2\}$

(E)  $\{3, 0, 2\}$

↓  
right 3

↓ right 3  
 $(-3, 0) \rightarrow (0, 0)$   
 $(0, 0) \rightarrow (3, 0)$   
 $(1, 0) \rightarrow (4, 0)$

11. If  $f(x) = 3x - \frac{9}{5}$ , then  $\frac{f(a) - f(b)}{a - b}$ ?

- (A) -3      (B) -1      (C) 0      (D) 1      (E) 3

$$f(a) = 3a - \frac{9}{5}$$

$$f(b) = 3b - \frac{9}{5}$$

$$\frac{3a - \frac{9}{5} - (3b - \frac{9}{5})}{a - b} = \frac{3a - 3b}{a - b} = \frac{3(a - b)}{a - b}$$

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

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

12. If  $f(x) = \frac{1}{x} + x + \frac{1}{x} + x$ , for all real number, which of the following will be true?

- (A)  $f(0) = 0$       (B)  $f(x) = f\left(\frac{1}{x}\right)$       (C)  $f(x) = f(-x)$   
 (D)  $f(x) = x$       (E)  $f(x) = \frac{1}{f(x)}$

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

13. If  $f(x) = \frac{3x - 2}{4}$ , where  $x > 0$ , for what values of  $x$  is  $f(x) < 0$ ?

- (A)  $0 < x < \frac{2}{3}$       (B)  $0 < x < 2$       (C)  $-2 < x < 4$   
 (D)  $0 < x < 3$       (E) No value of  $x$

14. For which of the following is  $f(3) = f\left(\frac{1}{3}\right)$ ?

- (A)  $f(x) = x^2$       (B)  $f(x) = 1 + \frac{1}{x}$       (C)  $f(x) = \frac{x+1}{x}$   
 (D)  $f(x) = \frac{1}{x} + x + \frac{1}{x} + x$       (E)  $f(x) = \frac{1}{x}$