

# Exam 1 Math 1112 sec. 52 Spring 2020

Name: Solutions

Your signature (required) confirms that you agree to practice academic honesty.

Signature: \_\_\_\_\_

Problem	Points
1	
2	
3	
4	
5	
6	
7	
8	
9	
10	
Total	

**INSTRUCTIONS:** There are 10 problems (most with multiple parts), worth 10 points each. There are no notes or books, allowed and **no calculator is allowed. Illicit use of a calculator, smart phone, tablet, device that runs apps, or notes will result in a grade of zero on this exam as well as a formal allegation of academic misconduct.** To receive full credit, answers must be clear, complete, and written using proper notation.

1. Let  $f(x) = \frac{2x}{x^2+1}$ ,  $g(x) = |3x-2|$ , and  $h(x) = 2x - \sqrt{x+1}$ .

Evaluate

(a)  $f(-2) = \frac{-4}{5}$

(b)  $f(4) = \frac{8}{17}$

(c)  $h(0) = 0 - \sqrt{1} = -1$

(d)  $h(3) = 6 - \sqrt{4} = 4$

(e)  $g\left(\frac{4}{3}\right) = \left|3\left(\frac{4}{3}\right) - 2\right| = |4 - 2| = 2$

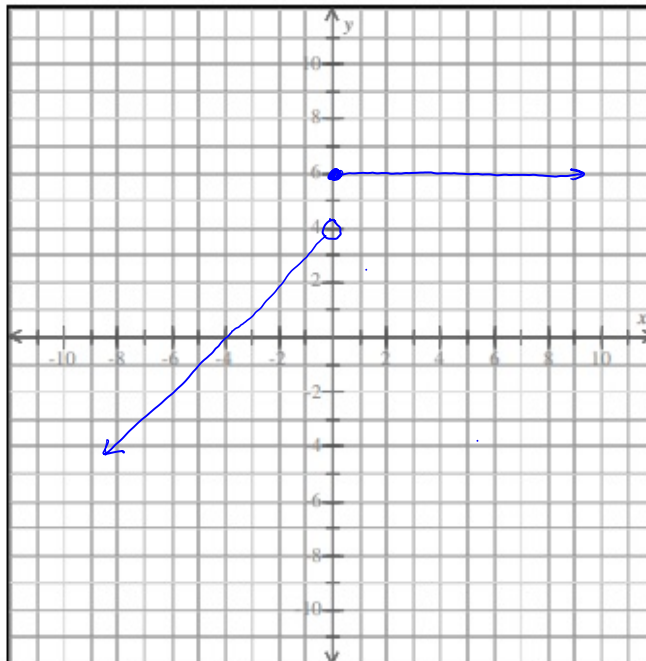
2. Let  $f(x) = \begin{cases} x + 4, & x < 0 \\ 6, & x \geq 0 \end{cases}$

(a) Evaluate  $f(0) = 6$

(b) Evaluate  $f(-2) = -2 + 4 = 2$

(c) If  $h > 0$ , evaluate  $f(-1 - h) = (-1 - h) + 4 = 3 - h$

(d) Graph the function  $f$  on the grid provided. Label any  $x$  and  $y$  intercepts.



(e) Is  $f$  continuous?

No, it jumps @  $x=0$ .

3. Find the domain of each function. Write your answer as an interval or a union of intervals.

(a)  $g(x) = \sqrt{2x-6}$        $2x-6 > 0 \Rightarrow 2x > 6 \quad x > 3$

The domain is  $[3, \infty)$

(b)  $f(x) = \frac{\sqrt{x+7}}{2x-1}$        $x+7 \geq 0 \Rightarrow x \geq -7$  and  $2x-1 \neq 0 \Rightarrow x \neq \frac{1}{2}$   
so  $x \geq -7$  and  $x \neq \frac{1}{2}$

The domain is  $[-7, \frac{1}{2}) \cup (\frac{1}{2}, \infty)$

4. Consider the line  $y = 3x - 2$ .

(a) Find the equation of the line that is parallel to this line and passes through the point (2, 1).  
(Put your answer in slope-intercept form  $y = mx + b$ .)

$m = 3$        $y - 1 = 3(x - 2) = 3x - 6$

$y = 3x - 5$

(b) Find the equation of the line that is perpendicular to this line and passes through the point (2, 1). (Put your answer in slope-intercept form  $y = mx + b$ .)

$m = -\frac{1}{3}$        $y - 1 = -\frac{1}{3}(x - 2) = -\frac{1}{3}x + \frac{2}{3}$

$y = -\frac{1}{3}x + \frac{2}{3} + 1 = -\frac{1}{3}x + \frac{5}{3}$

$y = -\frac{1}{3}x + \frac{5}{3}$

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

Evaluate

$$(a) (f+g)(2) = f(2) + g(2) = 5 + \sqrt{4} = 7$$

$$(b) (fg)(1) = f(1)g(1) = (2)(\sqrt{3}) = 2\sqrt{3}$$

$$(c) \left(\frac{g}{f}\right)(-1) = \frac{g(-1)}{f(-1)} = \frac{\sqrt{1}}{2} = \frac{1}{2}$$

$$(d) (g-f)(7) = g(7) - f(7) = \sqrt{9} - (50) = 3 - 50 = -47$$

$$(e) \left(\frac{f}{g}\right)(2) = \frac{f(2)}{g(2)} = \frac{5}{\sqrt{4}} = \frac{5}{2}$$

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

Evaluate

$$(a) (f \circ g)(1) = f(g(1)) = f(\sqrt{3}) = 3 + 1 = 4$$

$$(b) (g \circ f)(1) = g(f(1)) = g(2) = \sqrt{4} = 2$$

$$(c) (f \circ f)(2) = f(f(2)) = f(5) = 25 + 1 = 26$$

$$(d) (g \circ g)(7) = g(g(7)) = g(\sqrt{9}) = g(3) = \sqrt{5}$$

$$(e) (g \circ f)(x) = g(f(x)) = \sqrt{x^2 + 1 + 2} = \sqrt{x^2 + 3}$$

7. Solve the linear system of equations.

$$7x + 6y = -4$$

$$4x + 6y = 8$$

$$3x = -12$$

$$x = -4$$

$$\text{Sub. } 6y = -4 - 7x$$
$$= -4 - 7(-4)$$

$$= -4 + 28$$

$$= 24$$

$$y = \frac{24}{6} = 4$$

The solution  
is  
 $x = -4$   
 $y = 4$

8. Let  $g(x) = -x^2 + 3x$ . Find the difference quotient  $\frac{g(x+h) - g(x)}{h}$  for  $h \neq 0$ . Simplify your answer as much as possible.

$$g(x+h) = -(x+h)^2 + 3(x+h) = -(x^2 + 2xh + h^2) + 3x + 3h$$

$$= -x^2 - 2xh - h^2 + 3x + 3h$$

$$g(x+h) - g(x) = -x^2 - 2xh - h^2 + 3x + 3h - (-x^2 + 3x)$$

$$= -2xh - h^2 + 3h$$

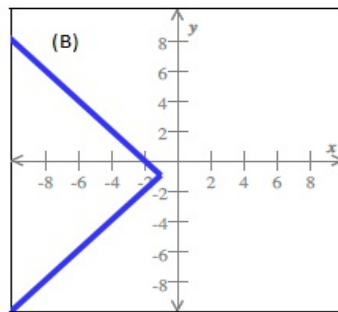
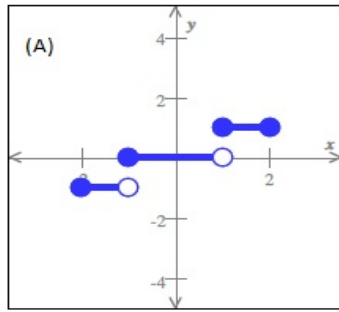
$$\frac{g(x+h) - g(x)}{h} = \frac{-2xh - h^2 + 3h}{h} = \frac{h(-2x - h + 3)}{h}$$

$$= -2x - h + 3$$

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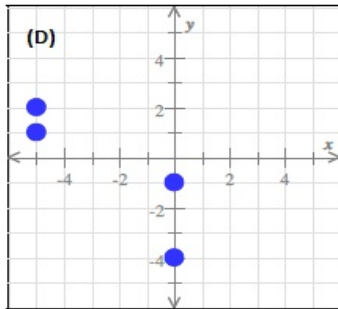
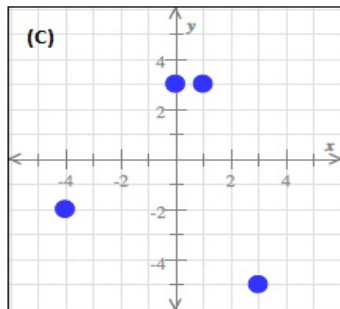
9. The figure shows the graphs of four relations. State whether each one represents a function. (Circle Yes or circle No)



Function?

(A) Yes or No

(B) Yes or No



(C) Yes or No

(D) Yes or No

(2 points) State in your own words how you determine if a graph represents a function.

The vertical line test is an option. A function can intersect every vertical line at most once.

10. The function  $T$  given by  $T(d) = 10d + 20$  can be used to determine the temperature  $T$ , in degrees Celsius, at a depth  $d$  kilometers inside the Earth.

(a) Find  $T(10)$ . Give your answer with appropriate units.

$$T(10) = 10(10) + 20 = 100 + 20$$

$$T(10) = 120^\circ \text{C}$$

(b) Determine the depth at which the temperature is  $50^\circ\text{C}$ ; include units in your answer.

$$T(d) = 50^\circ$$

$$50 = 10d + 20 \Rightarrow 10d = 30 \quad d = 3$$

The depth is 3 km.