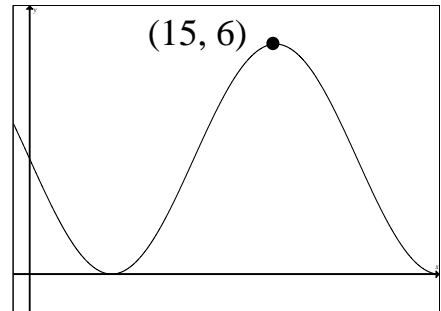


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 Class Meeting Time: \_\_\_\_\_

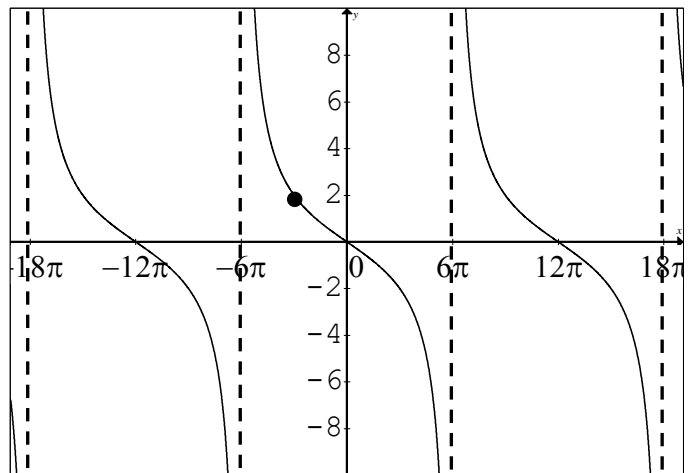
**MATH 1813, Exam 3(A), 100 points**  
**April 24, 2019**

Only **one** calculator may be used on the exam. No TI-89, TI-92, TI-Nspire, or similar calculators may be used. Cell phone calculators, computers, laptops, and tablets are also prohibited. You **MUST show work** in the space provided to receive full credit.

1. (8 pts.) Find a possible formula for the trigonometric function of the form  $y = A\sin(Bt) + k$  or  $y = A\cos(Bt) + k$ . Note that it has a minimum value of 0 and a maximum value of 6. **Show your work.**



2. (8 pts.) Give a possible formula for the tangent function that passes through the points  $(0, 0)$  and  $(-3\pi, 2)$ , with asymptotes at  $x = -6\pi$  and  $x = 6\pi$ . **Show your work.**



3. (8 pts.) Simplify the expression (for values of the variable for which it is defined). Write your answer as a single trigonometric function in simplest form. **Show your work.**

$$\cos(t) + \tan(t)\sin(t)$$

4. (9 pts.) Evaluate each of the following. Give exact answers. **Show your work.**

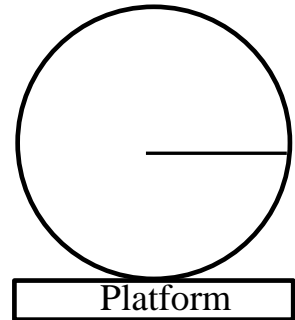
(a)  $\cos^{-1}(0)$

(b)  $(\sin 45^\circ)^{-1}$

(c)  $\cos\left(\frac{6}{\pi}\right)^{-1}$

5. (8 pts.) Dwight is looking out the second story window of his house onto his beet farm. He sees his cousin Mose hiding among the plants, and wants to know how far away he is. Dwight knows the window is 20 feet above the ground, and when he looks at Mose the angle of depression is  $24^\circ$ . How far away is Mose from the house? Round to the nearest foot. **Show your work.**

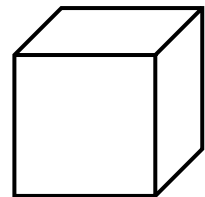
6. (9 pts.) The height  $H$  of a rider on a Ferris wheel with radius 200 feet can be determined by the equation  $H = 200\sin(\theta) + 200$ , where  $\theta$  is the angle as measured from the 3 o'clock position. Through what positive radian angle(s) does the Ferris wheel turn (counterclockwise) so that the rider's height above the platform is 100 feet? *Give exact answers; then round to 2 decimals. Show your work.*



7. (9 pts.) A 12-inch deep, cube-shaped fish tank is being filled with water. The height of the water in the tank is growing at a rate of 2 inches per minute.

[Hint: Volume of a cube is  $V = \text{length} \times \text{width} \times \text{height}$ .]

(a) Write a formula for the height of the water in the tank  $h$  (in inches) as a function of time  $t$  (in minutes).



(b) Write a formula for the volume of the water in the tank  $V$  (in cubic inches,  $\text{in}^3$ ) as a function of time  $t$  (in minutes).

(c) How long will it take for the fish tank to be completely filled with water? **Show your work.**

8. (6 pts.) Decompose  $k(x) = \sqrt{2x-3}$  into *three* simpler functions by giving formulas for  $f(x)$ ,  $g(x)$ , and  $h(x)$  such that  $k(x) = f(g(h(x)))$ . Assume  $f(x) \neq x$ ,  $g(x) \neq x$ , and  $h(x) \neq x$ .

Answers:

$f(x) =$  \_\_\_\_\_       $g(x) =$  \_\_\_\_\_       $h(x) =$  \_\_\_\_\_

9. (8 pts.) Bacteria on a kitchen counter can be modeled by  $P = f(t) = 2 + 0.5(1.035)^t$ , where  $P$  is measured in grams and  $t$  is time in minutes since the first measure was taken.

(a) Find a formula for  $f^{-1}(P)$ . **Show your work.**

(b) Evaluate  $f^{-1}(10)$  and **explain** its meaning in practical terms. *Round to 1 decimal. Include units. Show your work.*

Explain:

10. (8 pts.) Let  $f(t)$  be the number of men and  $g(t)$  be the number of women in Canada in year  $t$ . Let  $h(t)$  be the average income, in Canadian dollars, of women in Canada in year  $t$ .

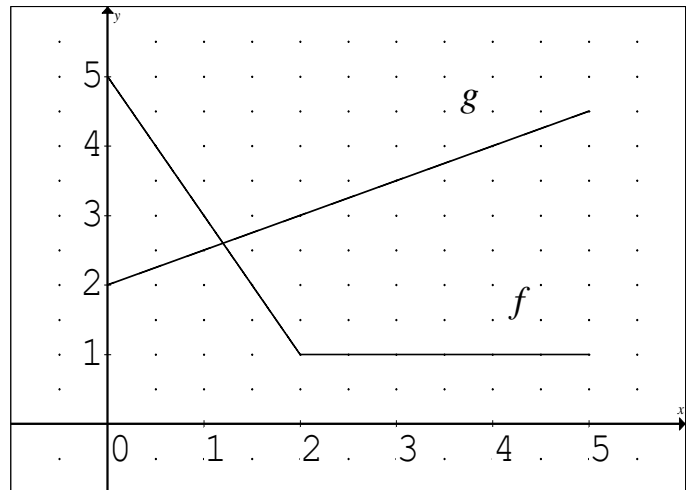
(a) Find the function  $p(t)$  that gives the number of **men and women** in Canada in year  $t$ .  
 [Hint: Your function should be written in terms of  $f(t)$ ,  $g(t)$ , and/or  $h(t)$ .]

(b) Find the total amount of money  $m(t)$  earned by Canadian **women** in year  $t$ .  
 [Hint: Your function should be written in terms of  $f(t)$ ,  $g(t)$ , and/or  $h(t)$ .]

11. (9 pts.) Use the graphs of  $f$  and  $g$  to find each of the following.

(a) Solve  $g(f(x)) = 3$  for  $x$ .

(b) Find  $f(g^{-1}(2))$ .



(c) If  $h(x) = f(x) + [g(x)]^2$ , find  $h(2)$ . **Show your work.**

12. (10 pts.) Is the function a power function? If so, write it in the form  $f(x) = kx^p$  and identify the values for  $k$  and  $p$ . **Show your work.**

(a)  $g(x) = \frac{\sqrt{16x}}{11x^{1/4}}$

(b)  $h(x) = (8ex^3)(4x^{-1})$

Power function? \_\_\_\_\_

Power function? \_\_\_\_\_

If so,  $k =$  \_\_\_\_\_ and  $p =$  \_\_\_\_\_.

If so,  $k =$  \_\_\_\_\_ and  $p =$  \_\_\_\_\_.

**5 BONUS POINTS**

Find possible formulas for  $f$  and  $g$  given that

$f(g(x)) = e^{3x-12}$       and       $g(f(x)) = e^{3x} - 4.$

Give only one function  $f$  and one function  $g$  that work for both compositions.

$f(x) =$  \_\_\_\_\_

$g(x) =$  \_\_\_\_\_