

By providing my signature below I acknowledge that I abide by the University's academic honesty policy. This is my work, and I did not get any help from anyone else:

Name (sign): _____

Name (print): _____

Student Number: _____

Instructor's Name: _____

Class Time: _____

Problem Number	Total Points Possible	Points Made
1	0	
2	20	
3	20	
4	16	
5	15	
6	15	
7	10	
8	15	
9	10	
10	10	
11	10	
12	10	
13	10	
14	10	
Total:	171	

- If you need extra space use the last page. *Do not tear off the last page!*
- Please show your work. **An unjustified answer may receive little or no credit.**
- If you make use of a theorem to justify a conclusion then state the theorem used by name.
- Your work must be **neat**. If we can't read it (or cannot find it), we cannot grade it.
- Please turn off your mobile phone.
- You are only allowed to use a TI-30 calculator. No other calculators are permitted.
- A calculator is not necessary, and answers should be given in a form that can be directly entered into a calculator. If you give a numerical value it should be to within one decimal place unless otherwise stated.
- Common identities:

$$\begin{aligned}\cos(\alpha + \beta) &= \cos(\alpha)\cos(\beta) - \sin(\alpha)\sin(\beta), \\ \sin(\alpha + \beta) &= \sin(\alpha)\cos(\beta) + \cos(\alpha)\sin(\beta).\end{aligned}$$

1. [2 Bonus] Common Knowledge: Provide a detailed argument about the feasibility of creating a women's version of Milano-Sanremo including the impacts on the Trofeo Alfredo Binda.

2. Determine all values of x that satisfy each equation below.

(a) [5 pts] $\frac{1}{\sqrt{8x-1}} = 7$

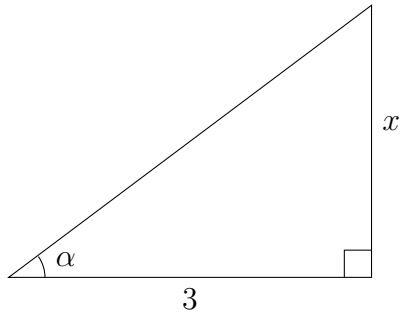
(b) [5 pts] $e^{3x^2} = 2.1$

(c) [5 pts] $8x^2 + 3x = 1$

(d) [5 pts] $3 \cdot 6^{4x+1} = 2 \cdot 6^{x-1}$

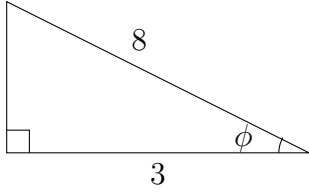
3. Determine the value of each of the requested quantities below. Numerical values should be to within 0.01 of the true value. (**All angles are given in radians and your answer should be expressed in radians if you have to determine their numerical value.**)

- (a) [5 pts] Determine the cosine, sine, and tangent of the angle α as a function of x in the diagram below.

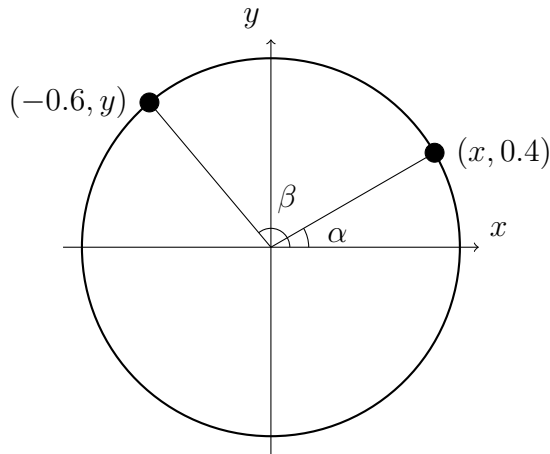


- (b) [5 pts] Determine the reference angle for $\theta = \frac{15\pi}{12}$ radians.

- (c) [5 pts] Determine the radian measure of the angle, ϕ , in the diagram below.



- (d) [5 pts] Determine the **exact** value of $\cos(\alpha + \beta)$ using the figure below. Do not use an inverse trigonometric function. The circle has a **radius of one**.



4. Three functions, $f(x)$, $g(x)$, and $h(x)$ are given below. Use the functions to answer each of the questions below.

$$f(x) = x^2, \quad g(x) = \begin{cases} \sqrt{-x} & x \leq 0, \\ x + 1 & x > 0, \end{cases} \quad h(x) = \frac{1}{\sqrt{x-1}}.$$

(a) [4 pts] Determine the value of $g(f(3))$

(b) [4 pts] Determine the value of $h(f(0))$

(c) [4 pts] What is the domain of the function $f(h(x))$?

(d) [4 pts] What is the average rate of change of the function $f(g(x))$ from $x = -4$ to $x = 2$?

5. The following questions refer to the function

$$g(x) = 4x^2 - 8x - 5.$$

(a) [5 pts] Does the function open upwards or downwards? (Explain your reasoning.)

(b) [5 pts] What are the coordinates, (x, y) , for the location of the vertex on the graph of the function?

(c) [5 pts] Determine all values of x where the function is negative.

6. For each scenario below circle the phrase that will best describe the **kind** of function that will best approximate the phenomena under consideration.

- (a) [5 pts] The price of a security increases by two dollars every month. *The price of the security as a function of time.*

Linear
Function

Quadratic
Function

Exponential
Function

Trigonometric
Function

- (b) [5 pts] The price of a security increases by three percent every month. *The price of the security as a function of time.*

Linear
Function

Quadratic
Function

Exponential
Function

Trigonometric
Function

- (c) [5 pts] The price of a security changes in seasonal cycles. It increases at the start of the year, decreases throughout the middle of the year, and then increases at the end of the year. *The price of the security as a function of time.*

Linear
Function

Quadratic
Function

Exponential
Function

Trigonometric
Function

7. One end of a rope is tied to the top of a wall thirty meters above the ground. The other end of the rope is in a coil on a cart that is on the ground. The cart is directly under the place at the top of the wall where the rope is tied. The cart is moved directly away from the wall, and the rope is always kept tight. (If you provide decimal numbers for your answers below, the values should be to within two decimal places of the true values.)

(a) [5 pts] How long will the rope be between the cart and the top of the wall when the cart is twenty meters from the wall?

(b) [5 pts] At a later time, the amount of rope between the cart and the top of the wall is seventy meters. What is the angle of elevation of the rope? (Your answer should be in radians.)

8. The number of decibels, D , for a sound is calculated using the function

$$D(I) = \log\left(\frac{I}{0.1}\right),$$

where I is the intensity of a sound.

(a) [5 pts] The intensity of a sound is $I = 10.0 \text{ W/m}^2$. How many decibels are associated with the sound? (Simplify your answer so that there is no logarithm in your final answer.)

(b) [5 pts] The intensity of a sound is $I = 10.0 \text{ W/m}^2$. What intensity for another sound would result in twice as many decibels compared to the original sound?

(c) [5 pts] Determine the inverse of $D(I)$. Briefly state what the inverse means. i.e. how do you interpret the input and output of the inverse function?

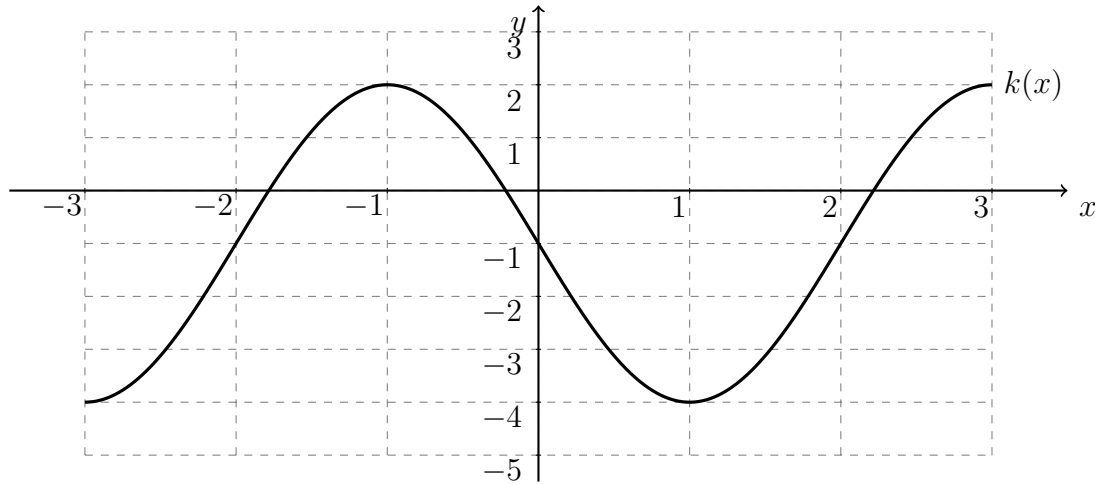
9. A factory produces 350 items each day, and at the start of day zero the factory has 275 of the items in its inventory. At the end of each day 358 items are shipped to another facility.
- (a) [5 pts] Determine a function that will give the number of items on hand at the end of any given day.

- (b) [5 pts] On what day will the total inventory to be reduced to zero items?

10. [10 pts] Determine a formula for the function whose graph is shown below expressed as a cosine function,

$$p(x) = A \cos(bx + c) + d.$$

The values of A and b should be positive numbers.



$$A =$$

$$b =$$

$$c =$$

$$d =$$

11. The intensity of light decreases as it passes through the canopy of a forest. The light intensity, I , is an exponential function of the distance, d , from the top of the canopy. The intensity of light is measured to be 1,000 lux ten meters from the top of the canopy, and the intensity of light is 800 lux at fifteen meters from the top of the canopy.

(a) [5 pts] Determine a function that gives the intensity of light given the distance from the top of the canopy.

(b) [5 pts] At what distance from the top of the canopy will the intensity of light be 500 lux?

12. [10 pts] Verify the following identity,

$$\frac{1}{1 + \sin(x)} - \frac{1}{1 - \sin(x)} = -2 \tan(x) \sec(x).$$

13. [10 pts] Simplify the expression,

$$\sin \left(\arccos(x + 1) + \arcsin \left(\frac{3}{5} \right) \right),$$

so that it is a function of x and there are no trigonometric functions.

14. [10 pts] Farmer Paul's paddock construction agency will build an animal pen. The pen will be in the shape of a rectangle, and gaps that are two meters wide will be left open on opposing ends of the rectangle. An additional fence will be placed in the middle of the rectangle to divide the pen into two equal parts, and the two gaps will be opposite to the divider fence. A total of 110 meters of fencing will be used. What dimensions of the pen will maximize the total area?

Extra space for work. **Do not detach this page.** If you want us to consider the work on this page you should print your name, instructor and class meeting time below.

Name (print): _____ Instructor (print): _____ Time: _____