

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	30	
3	20	
4	15	
5	20	
6	15	
7	15	
8	10	
9	15	
10	15	
11	15	
12	10	
13	15	
Total:	195	

- 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**. This will make it easier to properly grade and give you the credit you deserve.
- Please turn off your mobile phone. No watches are allowed during the exam.
- 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. Common Knowledge: What will it take for the UCI to mandate GPS tracking for all riders on a team?

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

(a) $\ln(2x + 1) = \frac{1}{5}$

(b) $\frac{2}{\sqrt{1 - 3x}} = 7$

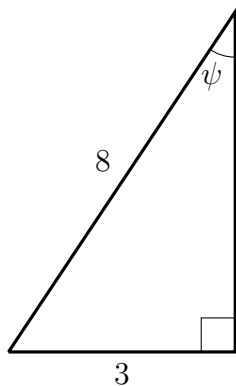
(c) $\frac{1}{(x-1)^2} = \frac{3}{x+4}$

(d) $5e^{6x+1} = e^{3x}$

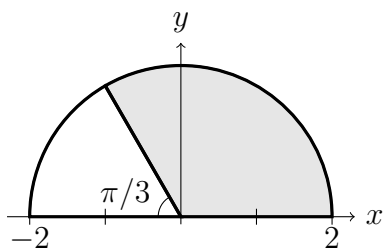
(e) $4 \cdot 3^x \cdot 2^{x+1} = 8 \cdot 5^x$

3. Determine the value of each of the requested quantities below. If an exact number is not requested, numerical values should be to within 0.01 of the true value. (**All angles are given in radians unless otherwise stated and your answer should be expressed in radians if you have to determine its numerical value.**)

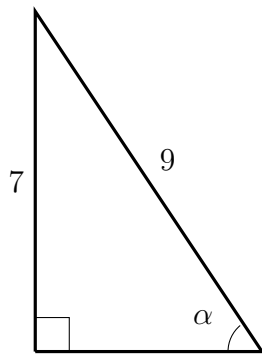
(a) Determine the sine, cosine, and tangent of the angle ψ as shown in the diagram below:



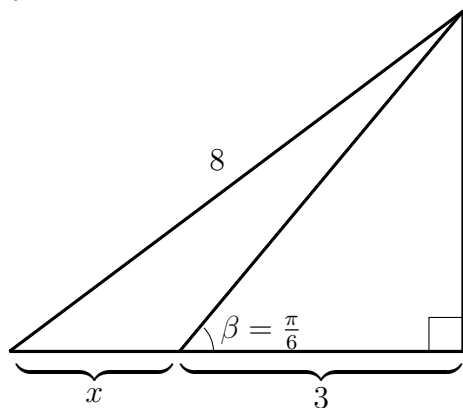
- (b) Part of a circle of radius two is shown in the diagram below. Determine the area of the shaded region.



- (c) Determine the radian measure of the angle α in the diagram below.



- (d) Determine the numerical value of x in the diagram below. The radian measure of β is $\frac{\pi}{6}$. ($\cos(\pi/6) = \frac{\sqrt{3}}{2}$ and $\sin(\pi/6) = \frac{1}{2}$)



4. Determine equations for the graphs of the relationships described in each of the scenarios below.

(a) The line that goes through the points $(-3, 6)$ and $(5, 9)$.

(b) A parabola decreases to a y -value of 4 as x increases to $x = 2$, and the y -value increases for $x > 2$. The y -intercept is at $(0, 10)$.

(c) A sine wave that goes through four cycles per second. It has a maximum of three and a minimum of negative one. The y -intercept is at $(0, 1)$.

5. Determine the **exact** numerical values of each of the values requested below. (Do not use a calculator.) (Your answer can be left as a product/sum of constant values. You do not have to evaluate the final expression.)

(a) Determine the value of a where $\ln(ax) = \ln(x) + 3.1$ for all $x > 0$.

(b) Determine the values of b and c where $\ln(c \cdot x^b) = \frac{1}{4} \ln(x) + 8.1$ for all $x > 0$.

(c) Determine the smallest, positive value of ϕ where $\cos\left(\phi + \frac{\pi}{3}\right) = 1$.

(d) Determine at least one value of a where the function

$$k(x) = \tan(\pi x - a)$$

is **not** defined when $x = 3$.

7. For each scenario below, circle the **kind** of function that will best approximate the phenomena under consideration.

- (a) The price of a security changes in time. The price increases at the start of the year, but then begins to decrease midway through the summer. The pattern repeats each year. *The price of the security as a function of the number of days since 01 January 2026.*

Linear
Function

Quadratic
Function

Exponential
Function

Trigonometric
Function

- (b) The price of a security depends on the inflation rate. The price decreases as the inflation rate increases when the inflation rate is less than 1.7%, but if the inflation rate is greater than 1.7% the price increases as the inflation rate increases. *The price of the security as a function of the inflation rate.*

Linear
Function

Quadratic
Function

Exponential
Function

Trigonometric
Function

- (c) The price of a security depends on the number of new hires nation wide. The price increases by five cents for each additional ten thousand new hires. *The price of the security as a function of the number of new hires.*

Linear
Function

Quadratic
Function

Exponential
Function

Trigonometric
Function

8. Determine the numerical value of each expression below. Your final answer should be exact (no calculator) and not include any trigonometric, logarithmic, nor exponential function. Your answer can be left as the product or sum of values, and your answer will be in terms of variables such as x or y .

(a) $\cos(\arcsin(x) - \arctan(3))$

(b) $\ln\left(\frac{e^{42} e^{-3y}}{e^{2x}}\right)$

9. Cuddles the adorable cat follows a stranger on the street and up to their apartment, where the cat runs in when the door is opened. The cat immediately runs to a window and spots a bench on the ground outside the apartment building. Cuddles knows that the bench is 40 meters from the base of the building, and while looking down the delightful cat estimates an angle of depression of 25° . If the height of each floor in the building is approximately three meters, give Cuddles your best estimate of what floor he is on so that Cuddles' person can be texted to come pick up the hungry beast. (*If you do not have a calculator briefly explain what values you would calculate and how you would decide the floor number.*) (Unlike Boyd Hall, the ground floor of the apartment building is floor one (1).)

10. A faculty member in the Botany Department wants to determine the rate that a plant takes up solar energy. The rate depends on the angle, ω , the sun's rays make with the vertical axis of the leaf. The faculty member is too lazy to do his own work, so he asks two graduate students to determine the formula. The first graduate student determines the relationship to be

$$SE1(\omega) = \sin(\omega) \cos^2(\omega) + \sin^3(\omega).$$

The second graduate student determines the relationship to be

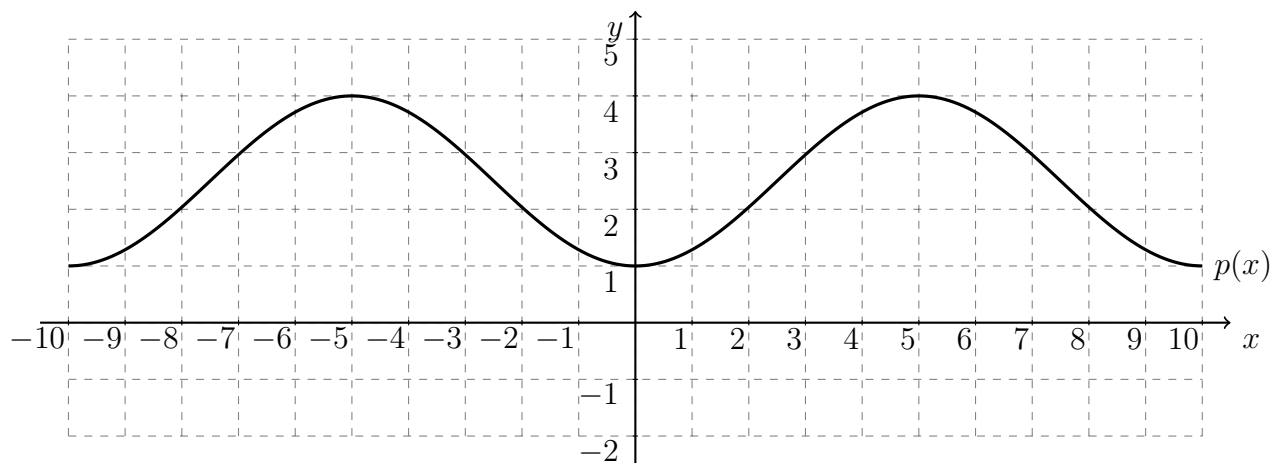
$$SE2(\omega) = \csc(\omega) - \cot(\omega) \cos(\omega).$$

The faculty member suspects that the two formulae are equivalent. Determine if this is the case and provide a convincing argument that even a faculty member can understand.

12. Determine the values of A , b , c , and D for the function

$$p(x) = A \cdot \cos(bx + c) + D$$

whose graph is shown below. The values of A and b should be positive numbers.



$A =$

$b =$

$c =$

$D =$

13. Shares of two securities, A and B, will be purchased. (It is possible to purchase a fraction of a share.) The volatility of the total portfolio depends on the number of shares purchased. A total of \$12,000 will be allocated. The cost of security A is sixty dollars per share, and the cost of security B is thirty dollars per share.

Volatility index for security A The volatility index for security A is the number of shares of A purchased plus three.

Volatility index for security B The volatility index for security B is 200 minus the number of shares of B purchased.

The total volatility index is the product of the two individual volatility indices. Determine how many shares of each security that should be purchased that will minimize the total volatility.

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: _____