

Print and sign a brief statement stating this is your work and you used no other resource:

Name (sign): _____

Name (print): _____

Student Number: _____

Instructor's Name: _____

Class Time: _____

Problem Number	Points Possible	Points Made
??	20	
??	28	
??	10	
??	20	
??	15	
??	14	
??	15	
??	10	
??	14	
??	15	
??	10	
??	10	
??	10	
Total:	191	

- 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.
- The total number of possible points that is assigned for each problem is shown here. The number of points for each subproblem is shown within the exam.
- 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, but numerical answers should be given in a form that can be directly entered into a calculator.

Common identities:

$$\cos(\alpha + \beta) = \cos(\alpha)\cos(\beta) - \sin(\alpha)\sin(\beta), \quad \sin(\alpha + \beta) = \sin(\alpha)\cos(\beta) + \cos(\alpha)\sin(\beta).$$

1. Please determine all values of x that satisfy each equation below. Print your answer(s) in the box provided.

(a)

$$\log_8(x^2 - 1) = 10,000$$

(b)

$$x =$$

$$18 \cdot 11^{1-4x} = 14^x$$

$$x =$$

(c)

$$\sqrt{x^2 + 3x - 2} = 5$$

$$x =$$

(d)

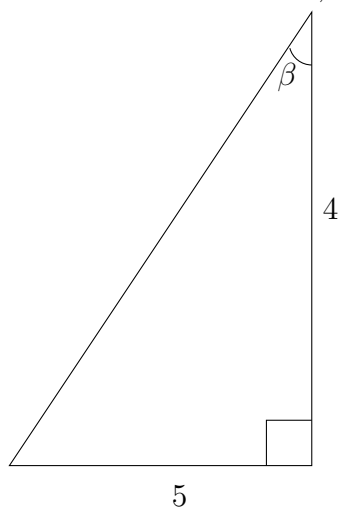
$\tan(x) = -18.5$ where x is in the fourth quadrant and $0 \leq x < 2\pi$. (Your answer should be in radians and can be the exact answer or approximate the answer to within two decimal places.)

$$x =$$

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

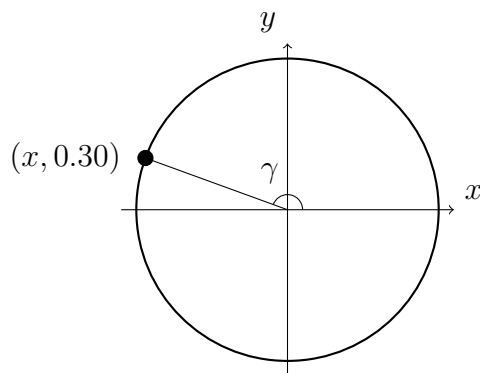
(a)

Determine the cosine, sine, and tangent of the angle β in the diagram below.



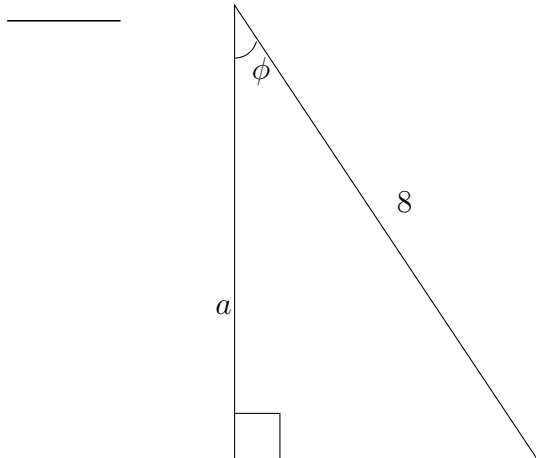
(b)

Determine the cosine, sine, and tangent of the angle, γ , in the diagram below. The point shown is on the unit circle.



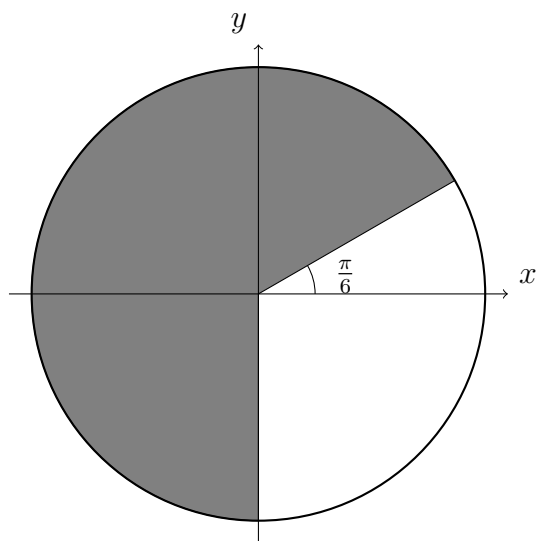
(c)

Determine a numerical approximation to the measure of the side a in the diagram below. Your answer should be to within 0.01 of the true value. The angle ϕ is 0.80 radians.



(d)

Determine the area of the shaded region below. The circle has a **radius of two**.



3. In each question below the formula for a function is given, and a question is posed about the function.

(a)

Please determine if the function

$$b(x) = 3x^2 - 5$$

is one-to-one. (Briefly explain your reasoning.)

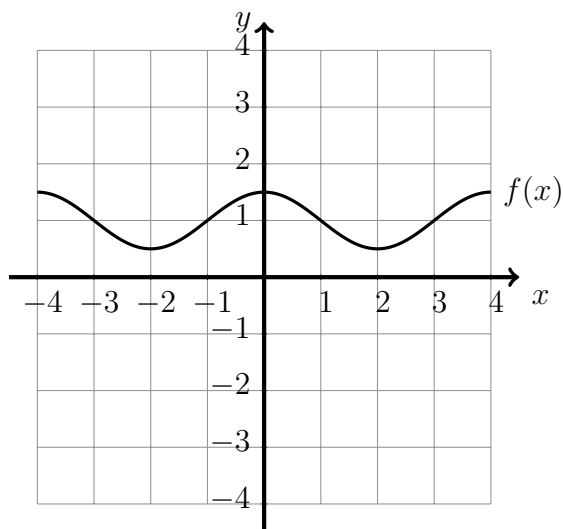
(b)

Please determine the range and domain of function

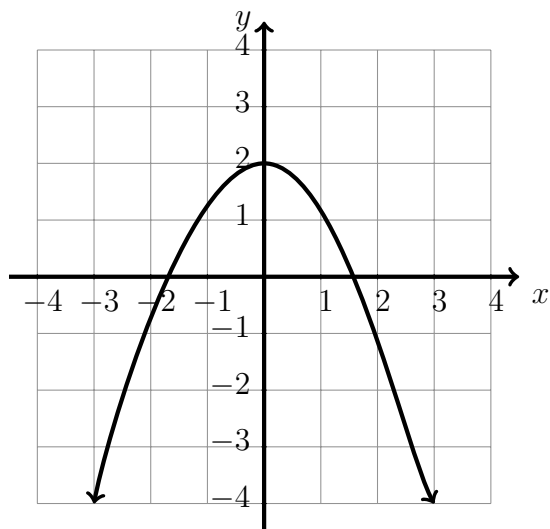
$$c(x) = \sqrt{1 - 2x}.$$

4. The graphs of a set of functions are given below. For each graph state whether or not the function is periodic. Also state whether or not the function is even, odd, or neither.

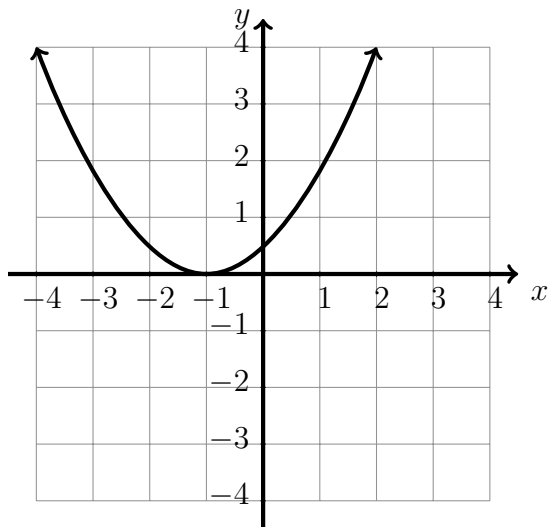
(a)



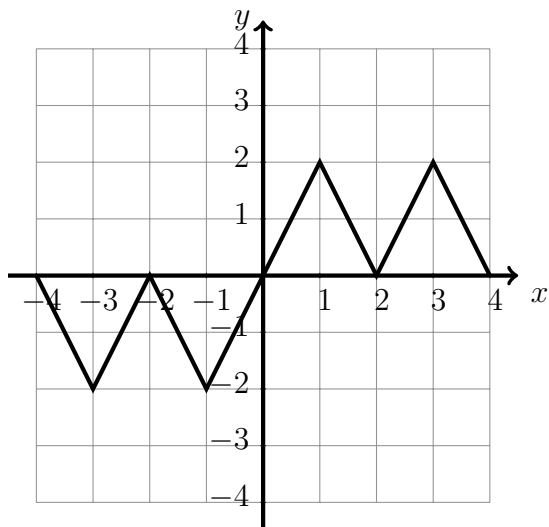
(b)



(c)



(d)



5. A function is given by

$$k(x) = 8x^2 - 3x + 2.$$

(a)

Please determine any coordinates on the graph of the function where a local maximum or a local minimum occur. (Briefly explain how you know the coordinates are a maximum or a minimum.)

(b)

Please determine the domain and range of the function.

(c)

Please determine and briefly explain whether or not the function is 1-1. If it is not 1-1 determine a restriction on the domain so that it is 1-1 on the restricted domain.

6. The questions below refer to the function

$$g(x) = m \cdot x + 4.$$

(a) The parameter m is a constant.

For what values of m is $g(x)$ an increasing function.

For what values of m is $g(x)$ a decreasing function.

(b)

What values of m will ensure that the two functions $f(x) = e^x$ and $g(x)$ will intersect for some positive value of x ($x > 0$). (Briefly explain your reasoning.)

(c)

What values of m will ensure that the two functions $f(x) = e^x$ and $g(x)$ will intersect for some negative value of x ($x < 0$). (Briefly explain your reasoning.)

(d)

7. For each scenario below circle the phrase that best describes the **kind** of function that will best approximate the phenomena described.

(a)

A vial of radioactive material is found. The amount of the material in the vial as a function of time.

Linear
Function

Quadratic
Function

Exponential
Function

Logistic
Function

Trigonometric
Function

(b)

A factory, NeveraCom, produces twenty new refrigerators an hour. The total number of refrigerators produced as a function of the time since the start of the day.

Linear
Function

Quadratic
Function

Exponential
Function

Logistic
Function

Trigonometric
Function

(c)

A carnival attraction has a teddy bear spinning on the end of a giant wheel that rotates at a constant rate. The height of the teddy bear above the ground as a function of time.

Linear
Function

Quadratic
Function

Exponential
Function

Logistic
Function

Trigonometric
Function

8. Determine the **exact** values of each of the expressions below. If an answer does not exist explain why.

(a)

$$\tan(\arccos(0.21))$$

(Do not use a value from a calculator but derive an expression for the exact value.)

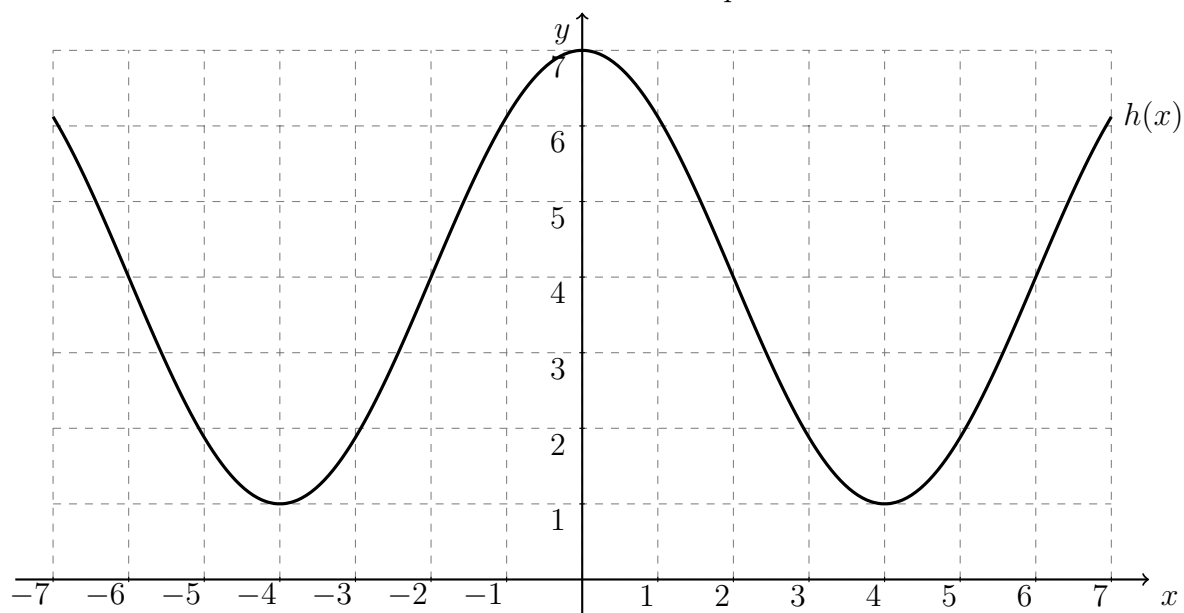
(b)

$$\cos(\arcsin(0.25) + \arccos(0.17))$$

(Do not use a value from a calculator but derive an expression for the exact value.)

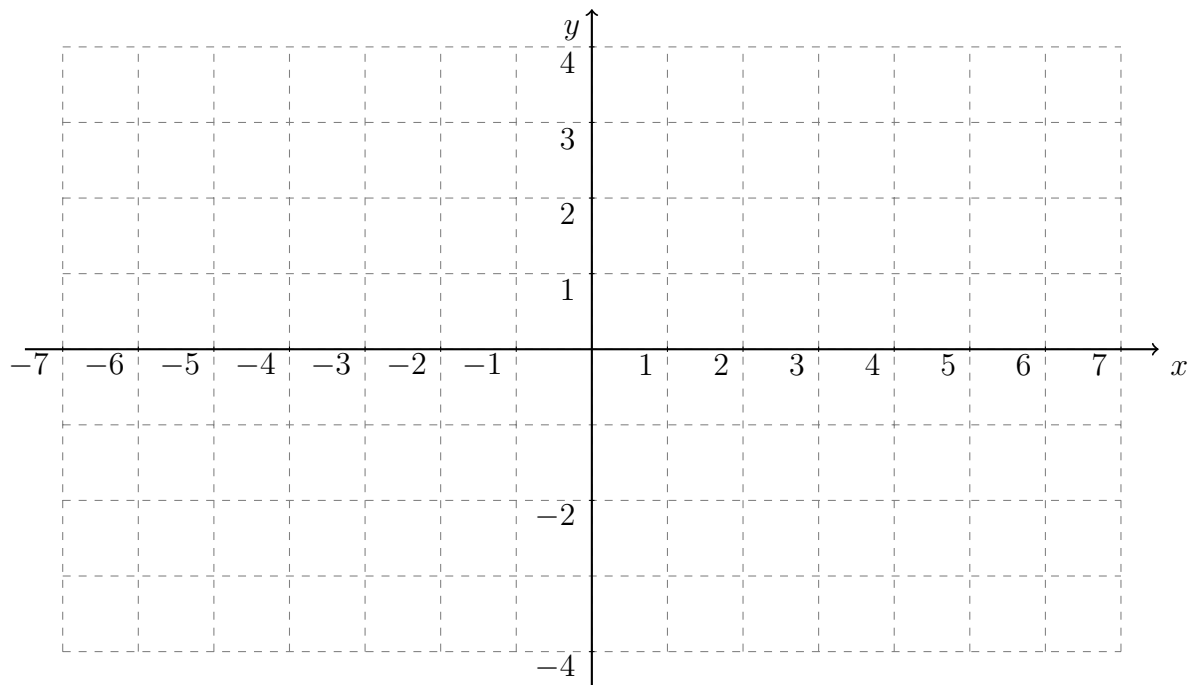
(a)

Please determine a formula for the function below expressed as a sine function.



(b)

Use the axis below to make a rough sketch of the function defined below, and **indicate and label two local maxima and two local minima**.



$$h(x) = 3 \sin\left(\frac{\pi}{3}x - \frac{\pi}{6}\right) - 1.$$

10. When a mortgage loan is made, a home buyer is provided with an initial amount of money, the principal - P . The home buyer then makes a monthly payment, A . The bank earns an interest rate each month, r , and n total payments are made by the home buyer. These values are related by the formula

$$A = \frac{Pr(1+r)^n}{(1+r)^n - 1}.$$

(a)

A home buyer purchases a home with a loan of \$180,000, at a monthly interest rate of 0.25% ($r = 0.0025$), and will have to make a monthly payment for 30 years. How much will the person's monthly payment be?

(b)

A person has a monthly interest rate of 0.25%, a monthly payment of \$2,100, and a 25 year loan. What was the initial principal?

(c)

A person has a monthly interest rate of 0.25%, a monthly payment of \$2,100, and the initial principal is \$190,000. How long will it take to pay off the loan?

11.

Ike's coffee shop offers a newsletter for its customers and currently has 250 people subscribing. Ike estimates that a new advertising campaign will attract 25 new people per month. Jane's shop currently has 4,000 subscribers for its newsletter. Jane expects that next year there will be 4,050 subscribers with the same number of new subscribers each subsequent year.

Please determine the two functions that will provide the total number of subscribers for each shop given the number of months after the start of the advertising campaigns. At what point in time after the start of the campaign will the two shops have the same number of subscribers?

12.

Farmer Bob has 200m of fencing, and he will be making a fenced in area for his chickens. He will construct two pens by first building one large rectangular area and then splitting it into two equal halves by adding a fence straight across the rectangle. What dimensions should he use to maximize the area and use up all of his fencing?

13. A state park maintains a herd of wild burros. It is estimated that the population can be approximated using a logistic equation,

$$P(t) = \frac{A}{1 - \frac{2}{5}e^{-rt}},$$

where t is the time in months since 1 January, 2018. The initial population is 500 animals, and after six months the population is 450. Determine the population after twelve months. What will the long term population be?

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: _____