Midterm 1

Math 112

Spring 2021

You have 50 minutes to complete this exam and scan and upload it to Canvas. **Show all your work. You may use a scientific calculator, but not a graphing one.** When you're finished, first check your work if there is time remaining, then scan the exam and upload it to Canvas. If you have a question, don't hesitate to ask — I just may not be able to answer it.

1. (32 points) Multiple choice. You don't need to show your work.

a) (8 points) A function f is even if for all x in its domain,

A) $f(-x) = -f(x)$.

B) $f(-x) = f(x)$.

C) $-f(x) = f(x)$.

D) $f(x) = f(f(x))$.

b) (8 points) For which of the following values of θ is $\cos(\theta) = 0$ and $\sin(\theta) = -1$?

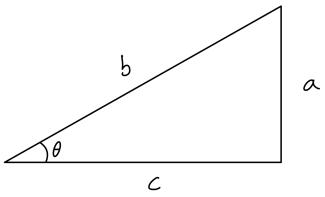
A) $\theta = 0°$.

B) $\theta = 90°$.

C) $\theta = 180°$.

D) $\theta = 270°$.

c) (8 points) In the following right triangle,



A) $\sin(\theta) = \dfrac{a}{b}$.

B) $\sin(\theta) = \dfrac{a}{c}$.

C) $\sin(\theta) = \dfrac{c}{a}$.

D) $\sin(\theta) = \dfrac{b}{c}$.

d) (8 points) The graph of $\cos(3x + 3)$ is the graph of $\cos(x)$, but

A) Horizontally stretched by a factor of 3 and shifted right 1.

B) Horizontally stretched by a factor of $\frac{1}{3}$ and shifted right 3.

C) Horizontally stretched by a factor of 3 and shifted left 3.

D) Horizontally stretched by a factor of $\frac{1}{3}$ and shifted left 1.

2. (32 points) Let $f(x) = \dfrac{1}{x^3}$.

a) (8 points) Is f an even function? Is it an odd one? Explain your answer.

b) (8 points) Sketch a graph of f, labeling at least two points.

c) (8 points) Sketch a graph of $\dfrac{2}{(x+1)^3}$. To receive credit, you must list each transformation you apply and sketch a graph after each one, as in class. Continue to label the points you labeled in part b).

d) (8 points) Apply a vertical shift of 3 units upward to the function in part c). Write the new equation of the function and sketch a graph. Again, continue to label the points you've been labeling for the past two parts.

3. (32 points) You go for a walk in a flat field. You first walk 3 miles east, then turn and walk another 2 miles south.

a) (8 points) You now walk home in a straight line. How many miles will you walk in that straight line before you get home? Leave your answer in exact form (i.e. no decimals).

b) (12 points) You left your house going due east and came home at an angle. What is the cosine of the angle between due east and the line you came home on? Again, leave your answer in exact form. (Hint: you don't need to find the angle itself.)

c) (12 points) You want that final walk home to be 4 miles. If you still start by walking 3 miles east, but now walk x miles south, then walk home in a straight line, what must x be?

4. (32 points) Consider a circle of radius 1 centered at the origin.

a) (8 points) What are the coordinates of a point on this circle with angle θ counter-clockwise from the positive x-axis?

b) (8 points) Now suppose the circle has radius 3. What are the coordinates of that point with angle θ now?

c) (8 points) A point on this circle with radius 3 has angle 150° from the positive x-axis. Sketch a picture of this point and find its coordinates, leaving them in exact form. You must explain how you calculate any trig functions to receive credit.

d) (8 points) If the circle were centered at $(-1, -2)$, what would the coordinates of that point be?