

Name _____

KUID _____

Instructor _____

Part 1: Multiple Choice (100 points). Circle the correct answer. Each question is worth 10 points and no partial credit is available.

1. The point $\left(\frac{\sqrt{3}}{2}, -\frac{1}{2}\right)$ on the unit circle corresponds to what angle?
- (a) $\frac{\pi}{6}$ (b) $\frac{7\pi}{6}$ (c) $\frac{5\pi}{3}$ (d) $\frac{11\pi}{6}$
2. Which of the following lines has the largest slope?
- (a) $2x - 3y = 10$
(b) $y = 2x - 4$
(c) $3y = x - 1$
(d) $y - x = 16$
3. What is the domain of the function $f(x) = \frac{4}{\sqrt{x-5}}$?
- (a) $(5, \infty)$
(b) $(-\infty, 4) \cup (5, \infty)$
(c) $[5, \infty)$
(d) All real numbers
4. What is the rectangular form of the point $(r, \theta) = \left(-3, \frac{\pi}{3}\right)$?
- (a) $(-1, -2)$ (b) $\left(-\frac{3}{2}, -\frac{3\sqrt{3}}{2}\right)$ (c) $\left(-\frac{3\sqrt{3}}{2}, -\frac{3}{2}\right)$ (d) $\left(-\frac{3\sqrt{2}}{2}, -\frac{3\sqrt{2}}{2}\right)$
5. Which of the following is equal to $\frac{x+2}{\sqrt{x^2-4x}}$?
- (a) $\cos\left(\arctan\left(\frac{x+4}{x}\right)\right)$
(b) $\sec\left(\arcsin\left(\frac{2}{x+2}\right)\right)$
(c) $\cot\left(\arcsin\left(\frac{2}{x+2}\right)\right)$
(d) $\csc\left(\arctan\left(\frac{x^2-4x}{2}\right)\right)$

6. Which of the following is the inverse of the function $g(x) = \frac{2}{x-4}$?

(a) $g^{-1}(x) = \frac{x-4}{2}$

(b) $g^{-1}(x) = \frac{2}{x+4}$

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

(d) $g^{-1}(x) = \frac{x+2}{4}$

7. The graph of $r = -2\cos(5\theta)$ is symmetric with respect to

(a) The polar axis

(b) The line $\theta = \frac{\pi}{2}$

(c) The pole

(d) All of the above

8. What type of conic section is $2x^2 - 4y^2 + 8y - 10 = 0$?

(a) Parabola

(b) Circle

(c) Hyperbola

(d) Ellipse

9. What are the zeros of the polynomial $x^3 - 4x^2 + 13x$?

(a) $x = 0, x = \pm 1, x = \pm 13$

(b) $x = 0, x = 2 \pm 3i$

(c) $x = 1, x = 3 \pm 2i$

(d) $x = 0, x = -4, x = 13$

10. What is the focus of the parabola $x^2 - 6x - 6y - 3 = 0$?

(a) $(3, \frac{1}{2})$

(b) $(-3, -\frac{5}{2})$

(c) $(3, -2)$

(d) $(3, -\frac{1}{2})$

Part 2: Short answer (100 points). Show all your work. Each question is worth 10 points and will be graded based on the accuracy of work shown. Answers should be exact unless otherwise stated.

11. Given that $\cos \beta = \frac{2}{3}$ and $\tan \beta < 0$, evaluate the other 5 trigonometric functions of β .
12. Find the vertex of the parabola $y = 3x^2 - 6x + 4$ algebraically.
13. A boat leaves its dock and travels for 5 miles in the direction perpendicular to the shore, then makes a 48° turn and travels another 3 miles. How far is the boat from the dock?

14. A golfer hits a golfball with an initial velocity of 120 ft./sec at an angle of 39° with the horizontal. The position of the ball is given by the equations

$$x = (v_0 \cos \theta)t \quad y = (v_0 \sin \theta)t - 16t^2 \quad 0 \leq t \leq 4$$

Where v_0 is the initial velocity and θ is the initial angle. The green is up on a hill, at a point 350 feet horizontally and 50 feet vertically from the tee. Will the ball make it on the green?

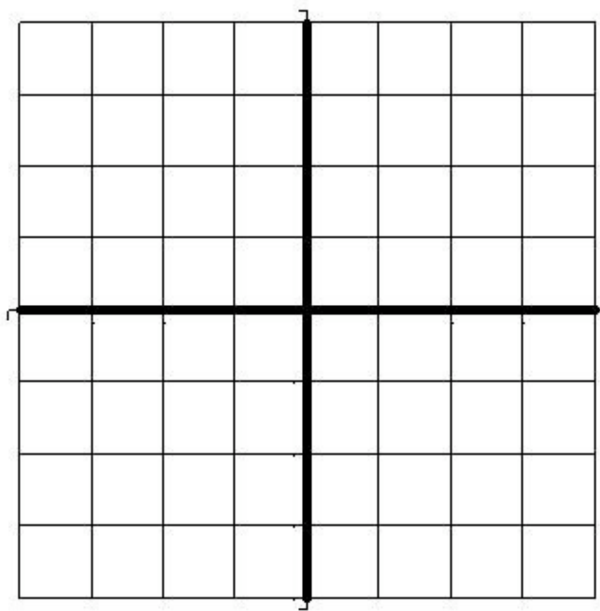
15. Identify the conic and find properties (center, vertices, foci), sketching a graph as an aid:

$$\frac{(x+5)^2}{4} + \frac{(y+2)^2}{12} = 1$$

16. Sketch a graph of the parametric equations for $0 \leq t \leq \pi$

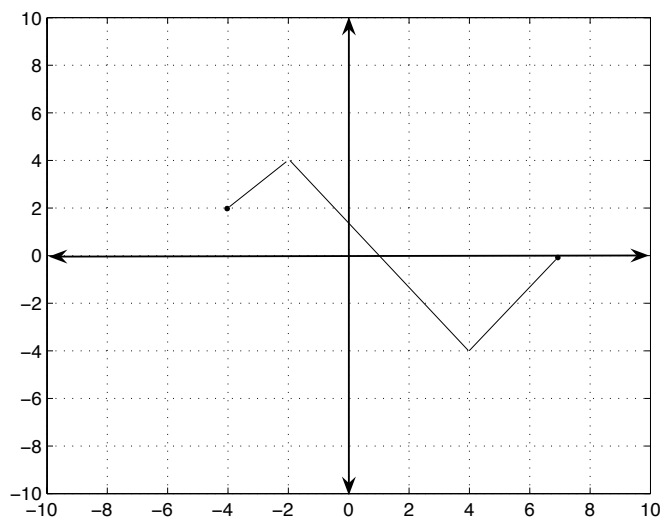
$$x = 5 + 3 \cos t$$

$$y = 2 + 5 \sin t$$



17. You find that a tower casts a 373 ft. shadow when the sun is at an angle of elevation of 15° . How tall is the tower?

18. Give the maximum and minimum values of the function below, as well as the intervals on which it is increasing and decreasing.



19. Find all solutions of the following equation in the interval $[0, 2\pi)$:

$$\cos x - 2 \sin x \cos x = 0$$

20. Describe the transformations of the function $f(x) = -\sqrt{x-5} + 2$ from the parent function $p(x) = \sqrt{x}$.

Part 3: Long Answer (100 points). Show all your work. Each question is worth 20 points and will be graded based on the accuracy of work shown. Answers should be exact unless otherwise stated.

21. Prove the trigonometric identity: $\frac{\cos^3 \alpha}{\sin \alpha} + \sin \alpha \cos \alpha = \cot \alpha$
22. What are the amplitude and period of the function $s(x) = -2 \cos\left(\frac{x}{3}\right)$? Graph two full periods of $s(x)$, labeling 2 x-intercepts and 2 additional points.

23. The temperature (in Fahrenheit) of a cup of coffee t minutes after poured is modeled by the equation

$$F(t) = 65 + 115e^{-0.1t}$$

What temperature was the coffee when poured? If you want to drink the coffee when it is approximately 120° , how long should you wait?

24. Evaluate the difference quotient $\frac{f(x+h) - f(x)}{h}$ for the function $f(x) = 2x^2 - 3x + 1$.

25. Find all zeros of the polynomial $p(x) = 3x^4 - 11x^3 + 4x^2 + 14x - 24$, given that $1 - i$ is a zero. Use the zeros to write p in completely factored form.