Precalculus
Final Exam

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This exam is comprehensive over the entire course and includes 12 questions. You have 60 minutes to complete the exam.

The exam is worth 100 points. The 8 multiple choice questions are worth 5 points each (40 points total) and the 4 free response questions are worth 15 points each (60 points total).

Mark your multiple choice answers on this cover page. For the free response questions, show your work and make sure to circle your final answer.

1. (5 pts)	A	B	C	D	E
2. (5 pts)	A	B	C	D	E
3. (5 pts)	A	B	C	D	E
4. (5 pts)	A	B	C	D	E
5. (5 pts)	A	B	C	D	E
6. (5 pts)	A	B	C	D	E
7. (5 pts)	A	B	C	D	E
8. (5 pts)	A	B	C	D	E

1. **(5 pts)** Convert $r = 1 + \tan\theta$ into rectangular coordinates.

    $\boxed{\text{A}}$ $x^2 + y^2 = 1 + \dfrac{x}{y}$
                   $\boxed{\text{D}}$ $x^2 + y^2 = 1 + \dfrac{y}{x}$

    $\boxed{\text{B}}$ $x^2 + y^2 = \left(1 + \dfrac{x}{y}\right)^2$
         $\boxed{\text{E}}$ $x^2 + y^2 = \left(1 + \dfrac{y}{x}\right)^2$

    $\boxed{\text{C}}$ $x^2 + y^2 = 1 + \dfrac{x^2}{y^2}$

2. **(5 pts)** Which equation is the equation of a cardioid?

    $\boxed{\text{A}}$ $r = 2\sin\theta$
    $\boxed{\text{C}}$ $r = 2\sin\theta + 2$
    $\boxed{\text{E}}$ $r^2 = 2\sin 2\theta$

    $\boxed{\text{B}}$ $r = \sin 2\theta$
    $\boxed{\text{D}}$ $r = 2\sin 2\theta + 2$

3. **(5 pts)** If $a = 1 - 3i$ and $b = 1 + 3i$, find a/b.

A 1

B $-\dfrac{4}{5} - \dfrac{3}{5}i$

C $1 + \dfrac{3}{5}i$

D 10

E $-\dfrac{4}{5} + \dfrac{3}{5}i$

4. **(5 pts)** Find the product of the matrices.

$$\begin{bmatrix} 1 & 3 \\ 0 & -1 \end{bmatrix} \begin{bmatrix} 2 & 0 \\ -1 & -2 \end{bmatrix}$$

A $\begin{bmatrix} -1 & -6 \\ 1 & 2 \end{bmatrix}$

B $\begin{bmatrix} 2 & 6 \\ -1 & -1 \end{bmatrix}$

C $\begin{bmatrix} 5 & 6 \\ -1 & -2 \end{bmatrix}$

D $\begin{bmatrix} 2 & 6 \\ -1 & -5 \end{bmatrix}$

E $\begin{bmatrix} -1 & 1 \\ -6 & 2 \end{bmatrix}$

5. **(5 pts)** Find the partial fractions decomposition of the rational function.

$$f(x) = \frac{2}{x(x^2 - 1)}$$

A $\quad f(x) = \dfrac{1}{x} - \dfrac{2}{x+1} + \dfrac{1}{x-1}$

D $\quad f(x) = \dfrac{1}{1+x} - \dfrac{2}{x} + \dfrac{1}{1-x}$

B $\quad f(x) = \dfrac{2}{x} + \dfrac{1}{x+1} + \dfrac{1}{x-1}$

E $\quad f(x) = \dfrac{2x}{x^2 - 1} - \dfrac{2}{x}$

C $\quad f(x) = \dfrac{1}{x+1} + \dfrac{1}{x-1} - \dfrac{2}{x}$

6. **(5 pts)** Find the foci of the hyperbola.

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

A $\quad (1, -1 \pm \sqrt{5})$

C $\quad (-1, -1 \pm \sqrt{13})$

E $\quad (-1, 1 \pm \sqrt{5})$

B $\quad (-1, 1 \pm \sqrt{13})$

D $\quad (-1 + \sqrt{5}, 1)$

7. **(5 pts)** Eliminate the parameter.

$$x = \frac{t+1}{2} \qquad\qquad y = t^2 + 1$$

A $\quad y = \left(\dfrac{x+1}{2}\right)^2 + 1$

D $\quad y = 4x^2 - 4x + 2$

B $\quad y = \dfrac{x^2}{2}$

E $\quad y = 4x^2 + 4x$

C $\quad y = x + t^2 - \dfrac{t}{2} + \dfrac{1}{2}$

8. **(5 pts)** Find the parametric representation of the ellipse.

$$\frac{(x-1)^2}{4} + \frac{(y-2)^2}{9} = 1$$

A $\quad x = 1 + 4\cos t \qquad\qquad\qquad y = 2 + 9\sin t$

B $\quad x = 1 + 2\cos t \qquad\qquad\qquad y = 2 + 3\sin t$

C $\quad x = 4 + \cos t \qquad\qquad\qquad y = 9 + 2\sin t$

D $\quad x = 2\cos(t+1) \qquad\qquad\qquad y = 3\sin(t+2)$

E $\quad x = 1 + \cos\left(\dfrac{t}{4}\right) \qquad\qquad\qquad y = 2 + \sin\left(\dfrac{t}{9}\right)$

9. **(15 pts)** Solve the equation.

$$z^3 + i = 0$$

10. **(15 pts)** Use a matrix and Gauss-Jordan elimination to find the solution to the system of equations.

$$x - 3y = 8$$

$$2x + y = 2$$

11. **(15 pts)** Find the partial fractions decomposition of the function.

$$f(x) = \frac{5x - 6}{(x^2 + 4)(x + 2)}$$

12. **(15 pts)** Find the eccentricity of the conic section.

$$2x^2 - 4xy + 2y^2 - x + 5 = 0$$