MATH 152, Fall 2017
COMMON EXAM II - VERSION B

LAST NAME(print): ________________________________________  FIRST NAME(print): ________________________________________

INSTRUCTOR: ____________________________________________

SECTION NUMBER: __________________

DIRECTIONS:

1. The use of a calculator, laptop or computer is prohibited.

2. TURN OFF cell phones and put them away. If a cell phone is seen during the exam, your exam will be collected and you will receive a zero.

3. In Part 1 (Problems 1-16), mark the correct choice on your ScanTron using a No. 2 pencil. The scantrons will not be returned, therefore for your own records, also record your choices on your exam!

4. In Part 2 (Problems 17-19), present your solutions in the space provided. Show all your work neatly and concisely and clearly indicate your final answer. You will be graded not merely on the final answer, but also on the quality and correctness of the work leading up to it.

5. Be sure to write your name, section number and version letter of the exam on the ScanTron form.

THE AGGIE HONOR CODE

“An Aggie does not lie, cheat or steal, or tolerate those who do.”

Signature: ________________________________________________
Part 1: Multiple Choice (5 points each)

1. Find the arc length for the parameterized curve given by \( x = e^t - t, \ y = 4e^{t/2}, \ 0 \leq t \leq 3. \)
   
   (a) \( e^3 + 3 \)
   (b) \( e^3 + 2 \)
   (c) \( e^3 + 1 \)
   (d) \( e^3 - 1 \)
   (e) \( e^3 - 2 \)

2. What would be an appropriate substitution in order to evaluate \( \int \frac{dx}{(x^2 + 6x + 13)^{3/2}} \)?
   
   (a) \( x + 2 = 3 \sec \theta \)
   (b) \( x + 3 = 2 \sec \theta \)
   (c) \( x + 3 = 2 \tan \theta \)
   (d) \( x + 2 = 3 \tan \theta \)
   (e) \( x + 2 = 3 \sin \theta \)

3. Rewrite the parametric curve given by \( x = \sin t, \ y = \tan(2t), \ 0 \leq t \leq \pi/6, \) in Cartesian form.
   
   (a) \( y = \frac{x}{\sqrt{1 - x^2}}, \ 0 \leq x \leq \frac{1}{2}. \)
   (b) \( y = \frac{2x}{1 - 2x^2}, \ 0 \leq x \leq \frac{1}{2}. \)
   (c) \( y = 2x, \ 0 \leq x \leq \sqrt{3}. \)
   (d) \( y = \frac{2x\sqrt{1 - x^2}}{1 - 2x^2}, \ 0 \leq x \leq \frac{1}{2}. \)
   (e) \( y = \frac{4x\sqrt{1 - x^2}}{1 - 2x^2}, \ 0 \leq x \leq \frac{\sqrt{3}}{2}. \)
4. Find the area of the region inside the circle $r = 6 \sin \theta$ and outside the circle $r = 3$.

(a) $\frac{9\sqrt{3}}{2} + 9\pi$
(b) $\frac{9\sqrt{3}}{4} - \frac{3\pi}{2}$
(c) $\frac{9\sqrt{3}}{2} + 3\pi$
(d) $\frac{9\sqrt{3}}{4} + \frac{3\pi}{2}$
(e) $\frac{\sqrt{3\pi}}{2} - 9\sqrt{3}$

5. What is the area inside the cardioid $r = 2 + \cos \theta$?

(a) $\frac{9\pi}{2}$
(b) $\frac{9\pi}{2} + 2$
(c) $4\pi + 2$
(d) $9\pi$
(e) $4\pi$
6. Find the arc length of the curve parameterized by \( x = 3 \sin(2t), \ y = 3 \cos(2t), \ 0 \leq t \leq \frac{\pi}{4} \)

(a) \( 3\pi \)
(b) \( \frac{3\pi}{4} \)
(c) \( 3\sqrt{2}\pi \)
(d) \( \frac{3\sqrt{2}\pi}{2} \)
(e) \( \frac{3\pi}{2} \)

7. Which of the following correctly represents the surface area obtained when the parametric curve given by \( x = t \sin t, \ y = t \cos t, \ 0 \leq t \leq \frac{\pi}{2} \), is rotated about the \( y \)-axis?

(a) \( 2\pi \int_0^{\pi/2} (t \sin t) \sqrt{1 + t^2 + 4t \sin t \cos t} \ dt \).
(b) \( 2\pi \int_0^{\pi/2} t^2 \sin t \ dt \).
(c) \( 2\pi \int_0^{\pi/2} t^2 \cos t \ dt \).
(d) \( 2\pi \int_0^{\pi/2} (t \sin t) \sqrt{1 + t^2} \ dt \).
(e) \( 2\pi \int_0^{\pi/2} (t \cos t) \sqrt{1 + t^2} \ dt \).

8. Evaluate \( \int_{-1}^{1} \ln |2x| \ dx \).

(a) \( \infty \).
(b) \( -\infty \).
(c) \( 4 \ln(4) \).
(d) \( 2 \ln(2) - 2 \).
(e) \( 4 \ln(2) - 4 \).
9. Which of the following is the correct partial fraction decomposition for \( \frac{1}{x^2(x^2 - 1)(x^2 + 1)} \)?

(a) \( \frac{Ax + B}{x^2} + \frac{Cx + D}{x^2 - 1} + \frac{Ex + F}{x^2 + 1} \)

(b) \( \frac{A}{x} + \frac{B}{x^2} + \frac{Cx + D}{x^2 - 1} + \frac{Ex + F}{x^2 + 1} \)

(c) \( \frac{A}{x} + \frac{B}{x^2} + \frac{C}{x + 1} + \frac{D}{x - 1} + \frac{Ex + F}{x^2 + 1} \)

(d) \( \frac{A}{x^2} + \frac{B}{x^2 - 1} + \frac{C}{x^2 + 1} \)

(e) \( \frac{A}{x} + \frac{B}{x^2} + \frac{C}{x + 1} + \frac{D}{(x + 1)^2} + \frac{E}{x - 1} + \frac{F}{(x - 1)^2} \)

10. What is the equivalent Cartesian equation for the polar curve \( r = 4 \sin \theta \)?

(a) \( x^2 + (y - 2)^2 = 4 \)

(b) \( (x - 2)^2 + y^2 = 4 \)

(c) \( (x - 2)^2 + (y - 2)^2 = 4 \)

(d) \( x^2 + y^2 = 4 \)

(e) \( x^2 + y^2 = 2 \)

11. Which of the following pairs of polar coordinates are correct alternate representations of the point with polar coordinates \((2, \frac{5\pi}{6})\)?

(a) \((-2, \frac{5\pi}{6})\) and \((2, \frac{\pi}{6})\).

(b) \((-2, \frac{\pi}{6})\) and \((2, \frac{7\pi}{6})\).

(c) \((-2, \frac{5\pi}{6})\) and \((-2, \frac{\pi}{6})\).

(d) \((-2, \frac{11\pi}{6})\) and \((2, -\frac{\pi}{6})\).

(e) \((-2, -\frac{\pi}{6})\) and \((2, -\frac{7\pi}{6})\).
12. The improper integral \( \int_{-2}^{3} \frac{1}{x^3} \, dx \)

(a) diverges.
(b) converges to \( \frac{5}{72} \).
(c) converges to \( \frac{-1}{18} \).
(d) converges to \( \frac{1}{8} \).
(e) converges to \( \frac{13}{27} \).

13. Evaluate \( \int_{0}^{2} \frac{4x^2 + 5}{2x + 1} \, dx \).

(a) \( \ln 3 + 3 \)
(b) \( 4 \ln 3 + 4 \)
(c) \( 6 \ln 5 + 2 \)
(d) \( 3 \ln 5 + 2 \)
(e) \( 3 \ln 5 + 4 \)
14. The improper integral \( \int_2^\infty \frac{2}{e^x + \sqrt{x}} \, dx \)

(a) diverges by comparison to \( \int_2^\infty \frac{2}{\sqrt{x}} \, dx \).
(b) converges by comparison to \( \int_2^\infty \frac{2}{\sqrt{x}} \, dx \).
(c) converges by comparison to \( \int_2^\infty \frac{2}{e^x} \, dx \).
(d) diverges by comparison to \( \int_2^\infty (e^x + \sqrt{x}) \, dx \).
(e) diverges by comparison to \( \int_2^\infty e^x \, dx \).

15. After an appropriate substitution, the integral \( \int_2^\sqrt{3} \sqrt{4 - x^2} \, dx \) can be written as

(a) \( 2 \int_{\pi/2}^{\pi/3} \cos \theta \, d\theta \)
(b) \( 4 \int_{\pi/3}^{\pi/2} \cos^2 \theta \, d\theta \)
(c) \( 2 \int_{-\pi/6}^{\pi/4} \sec \theta \tan^2 \theta \, d\theta \)
(d) \( 4 \int_{\pi/6}^{\pi/2} \cos^2 \theta \, d\theta \)
(e) \( 2 \int_{\pi/6}^{\pi/2} \cos^2 \theta \, d\theta \)

16. Which of the following integrals correctly calculates the area enclosed by one loop of the rose given by \( r = \cos(3\theta) \)?

(a) \( \int_0^{\pi/6} \cos^2(3\theta) \, d\theta \)
(b) \( \frac{1}{2} \int_0^{\pi/6} \cos^2(3\theta) \, d\theta \)
(c) \( \int_0^{\pi/2} \cos^2(3\theta) \, d\theta \)
(d) \( \int_{-\pi/6}^{\pi/6} \cos^2(3\theta) \, d\theta \)
(e) \( \frac{1}{2} \int_{-\pi/2}^{\pi/2} \cos^2(3\theta) \, d\theta \)
Part 2: Work Out

**Directions:** Present your solutions in the space provided. *Show all your work* neatly and concisely and box your final answer. You will be graded not merely on the final answer, but also on the quality and correctness of the work leading up to it.

17. (8 points) Evaluate \[ \int_0^{2/3} \sqrt{4 - 9x^2} \, dx. \]
18. (8 points) Evaluate \( \int \frac{x^3 + 6x - 2}{x^4 + 6x^2} \, dx \).
19. (8 points) Find the equations of the tangent lines to the curve $x = 3t^2 + 1$, $y = 2t^2 + 1$ that pass through the point (4,3).