Name _____ **DUE DATE:** _____

Directions:

- *Read each problem carefully and use your knowledge of calculus to determine your answer.*
- *In order to receive FULL CREDIT you must either SHOW ALL WORK or EXPLAIN how you got your answer!! PLEASE NOTE: A multiple choice answer alone without any work will only receive half credit.*

1) $\int_{1/e}^{e^2} \left(\frac{x^3+1}{x}\right) dx =$

A. $\frac{e^6-1}{6e^2}$

B. $\frac{e^{12}+2e^6-1}{6}$

C. $\frac{e^9+e^3-1}{e^3}$

D. $\frac{e^9+9e^3-1}{3e^3}$

E. $\frac{e^9-1}{e^3}+\ln 2$

2) If $\frac{dy}{dt} = ky$ and $k \neq 0$, which of the following could be the equation of y?

A. $y = kx - 7$

B. $y = 95e^{kt}$

C. $y = 5 + \ln k$

D. $y = (x-k)^2$

E. $y = \sqrt[k]{x}$

3) If $f''(x) = x(x-2)(x+1)^2$, then the graph of f has points of inflection when $x =$

A. –2 and 1
B. 2 and –1
C. 2 and 0
D. –2 and 0
E. 0, 2 and –1

4) If $3x^2 - 4xy = 1$, then when $x = 1$, $\frac{dy}{dx} =$

A. $\frac{3}{2}$
B. 1
C. $\frac{1}{2}$
D. 0
E. $-\frac{1}{2}$

5) If $f(x) = \sec(3x)$, then $f'\left(\frac{3\pi}{4}\right) =$

A. $-3\sqrt{2}$
B. $-\frac{3\sqrt{2}}{2}$
C. $\frac{3}{2}$
D. $\frac{3\sqrt{2}}{2}$
E. $3\sqrt{2}$

6) If $f(x) = \tan(e^{2x})$, then $f''(x) =$

A. $2e^{2x}\sec^2(e^{2x})$

B. $8e^{2x}\tan(e^{2x})$

C. $4e^{2x}\sec^2(e^{2x})$

D. $8e^{4x}\sec^2(e^{2x})\tan(e^{2x})$

E. $4e^{2x}\sec^2(e^{2x})[2e^{2x}\tan(e^{2x}) + 1]$

7)

x	1	3	5
f(x)	4	k	3

Given that f is a continuous function on the interval [1,5] and that f takes values shown in the table. The function f will have two zeros in the interval [1,5] if $k =$

A. –1

B. 0

C. 1

D. 2

E. 3

8) If $f(x) = \begin{cases} x^3e^x & \text{for } 0 \le x < 1 \\ \dfrac{e^x}{x^3} & \text{for } 1 < x \le 3 \end{cases}$, then $\lim_{x \to 1} f(x)$ is

A. 0

B. 1

C. e

D. e^3

E. nonexistent

9) A particle moves along the y-axis so that its position at time $0 \le t \le 20$ is given by $y(t) = 5t - \frac{t^2}{3}$. At what time does the particle change direction?

A. 5 seconds
B. 7.5 seconds
C. 10 seconds
D. 15 seconds
E. 18 seconds

10) If a curve is defined by $f(x) = 1 - x\cos x$, an equation of the normal to the curve at $\left(\frac{\pi}{2}, 1\right)$ is

A. $y = \frac{\pi x}{2} + \frac{\pi}{2}$

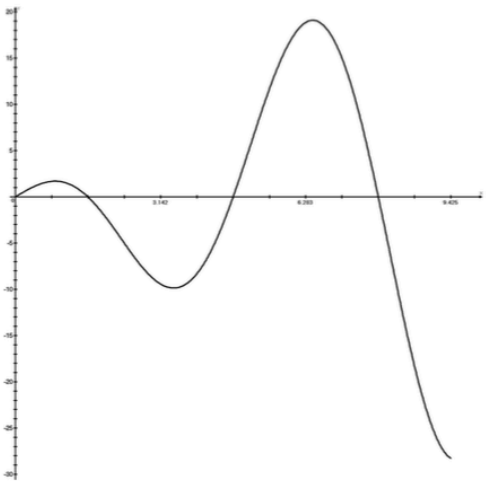
B. $y = \frac{\pi x}{2} + \left(\frac{\pi}{2}\right)^2$

C. $y = \frac{2x}{\pi} - 2$

D. $y = -\frac{2x}{\pi} + 2$

E. $y = -\frac{2x}{\pi} - 2$

11)



A particle moves along the x-axis so that its velocity v at time $t \geq 0$ is given by $v(t) = 3t\cos(t)$. The graph of v is shown above for $0 \leq t \leq 3\pi$. The position of the particle at time t is $x(t)$ and its position at time $t = 0$ is $x(0) = 5$.

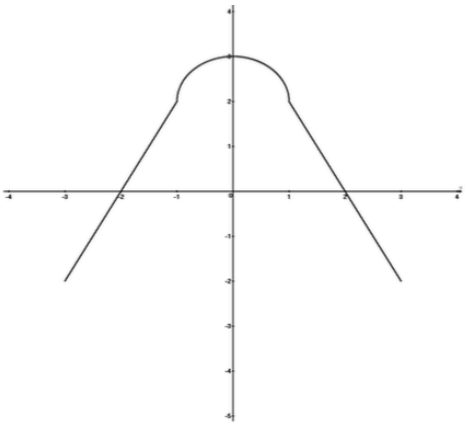
a. Find the acceleration of the particle at time $t = \pi$.

b. Find the total distance traveled by the particle from time $t = 0$ to $t = 3\pi$.

c. Find the position of the particle at time $t = \frac{3\pi}{2}$.

d. For $0 \leq t \leq 3\pi$, find the time t at which the particle is farthest to the left. Explain your answer.

12)



Let f be a function defined on the closed interval $-3 \le x \le 3$ with $f(-1) = -2.8$ and $f(1) = 2.8$. The graph of f', the derivative of f, consists of two line segments and a semicircle, as shown above.

a. For $-3 \le x \le 3$, find all values x at which f has a relative minimum. Justify your answer.

b. For $-3 \le x \le 3$, find all values x at which the graph of f has a point of inflection. Justify your answer.

c. Find all intervals on which the graph of f is increasing and concave down. Explain your reasoning.

d. Find the absolute maximum value of $f(x)$ over the closed interval $-3 \le x \le 3$. Explain your reasoning.