Student: ______________________	**Instructor:**	**Assignment:** Practice Problems for Test 2
Date: ______________________	**Course:** Math 1540 W OL	

1. At what points is the following function continuous?

$$y = \frac{x+4}{x^2 - 7x + 10}$$

- A. The function is continuous at all x except $x = -5$ or $x = 2$.
- B. The function is continuous at all x except $x = -2$ and $x = 5$.
- C. The function is continuous at all x except $x = 2$ and $x = 5$.
- D. The function is continuous at all x except $x = 2$.
- E. The function is continuous at all x.

$x^2 - 7x + 10 = 0$

$(x-5)(x-2) = 0$

$x \neq 5 \quad x \neq 2$

2. Find y′.

$$y = (x^2 - 4x + 2)(3x^3 - x^2 + 4)$$

- A. $15x^4 - 52x^3 + 30x^2 + 4x - 16$
- B. $3x^4 - 48x^3 + 30x^2 + 4x - 16$
- C. $3x^4 - 52x^3 + 30x^2 + 4x - 16$
- D. $15x^4 - 48x^3 + 30x^2 + 4x - 16$

$y' = (2x-4)(3x^3 - x^2 + 4) + (x^2 - 4x + 2)(9x^2 - 2x)$

$= 6x^4 - 2x^3 + 8x - 12x^3 + 4x^2 - 16$

$+ 9x^4 - 2x^3 - 36x^3 + 8x^2 + 18x^2 - 4x$

$= 15x^4 - 52x^3 + 30x^2 + 4x - 16$

3. Find y′.

$$y = \left(x + \frac{1}{x}\right)\left(x - \frac{1}{x}\right)$$

- A. $2x + \frac{1}{x^2}$
- B. $2x - \frac{1}{x^2}$
- C. $2x + \frac{1}{x^3}$
- D. $2x + \frac{2}{x^3}$

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

$= 2x + \frac{2}{x^3}$

4. Find the limit.

$$\lim_{x \to (-\pi/2)^-} \sec x$$

- A. 0
- B. ∞
- C. 1
- D. $-\infty$
- E. The limit does not exist.

$\sec x = \frac{1}{\cos x}$

5. Find the limit, if it exists.

$$\lim_{x \to 5} \frac{x^2 - 2x - 15}{x + 3}$$

$= \lim_{x \to 5} \frac{(x-5)(x+3)}{x+3} = \lim_{x \to 5} x-5$

$= 5-5 = 0$

- A. 5
- B. - 8
- C. 0 (selected)
- D. The limit does not exist.

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6. Find $\frac{dy}{dt}$.

$y = \cos^5(\pi t - 9)$

$\frac{dy}{dt} = -5\pi\cos^4(\pi t - 9)\sin(\pi t - 9)$

- A. $5\cos^4(\pi t - 9)$
- B. $-5\cos^4(\pi t - 9)\sin(\pi t - 9)$
- C. $-5\pi\cos^4(\pi t - 9)\sin(\pi t - 9)$ (selected)
- D. $-5\pi\sin^4(\pi t - 9)$

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7. Use implicit differentiation to find $\frac{dy}{dx}$.

$2xy - y^2 = 1$

$2x\frac{dy}{dt} + 2y - 2y\frac{dy}{dt} = 0$

$(2x - 2y)\frac{dy}{dt} = -2y$

$\frac{dy}{dt} = \frac{-2y}{2x-2y} = \frac{-y}{x-y} = \frac{y}{y-x}$

- A. $\frac{y}{x-y}$
- B. $\frac{y}{y-x}$ (selected)
- C. $\frac{x}{y-x}$
- D. $\frac{x}{x-y}$

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8. Find the derivative of the function $y = \sqrt{-7-3x}$. $= (-7-3x)^{\frac{1}{2}}$

$\frac{dy}{dx} = \frac{1}{2}(-7-3x)^{-\frac{1}{2}} \cdot -3$

$= \frac{-3}{2\sqrt{-7-3x}}$

9. Find the limit, if it exists.

$$\lim_{x \to 5} \frac{x^2 - 8x + 15}{x^2 - 2x - 15}$$

$= \lim_{x \to 5} \frac{(x-5)(x-3)}{(x-5)(x+3)} = \lim_{x \to 5} \frac{(x-3)}{(x+3)}$

$= \frac{5-3}{5+3} = \frac{2}{8} = \frac{1}{4}$

- A. 1
- B. $-\frac{1}{4}$
- C. $\frac{1}{4}$ (selected)
- D. The limit does not exist.

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10. Find the derivative of y with respect to x.

$y = \ln 8x^2$

$= \frac{1}{8x^2} \cdot 16x = \frac{16x}{8x^2} = \frac{2}{x}$

- A. $\frac{1}{2x + 8}$
- B. $\frac{2}{x}$ (selected)
- C. $\frac{16}{x}$
- D. $\frac{2x}{x^2 + 8}$

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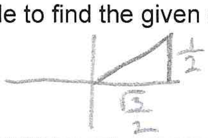
11. Use a reference triangle to find the given angle.

$\sin^{-1}\left(\frac{1}{2}\right)$



$\sin\theta = \frac{1}{2}$

$\sin^{-1}\left(\frac{1}{2}\right) =$ __________

(Type an exact answer in terms of π.)

$\theta = 30^\circ$ or $\frac{\pi}{6}$

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12. Find $\frac{dy}{dx}$ for $y = \frac{2}{x} + 9 \sin x$.

$\frac{d}{dx}\left(\frac{2}{x} + 9 \sin x\right) =$ __________

$y = 2x^{-1} + 9\sin x$

$y' = -2x^{-2} + 9\cos x$

$= -\frac{2}{x^2} + 9\cos x$

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13. Use implicit differentiation to find $\frac{dy}{dx}$ using the following equation.

$x^5 + y^5 = 35xy$

$\frac{dy}{dx} = \frac{35y - 5x^4}{5y^4 - 35x}$

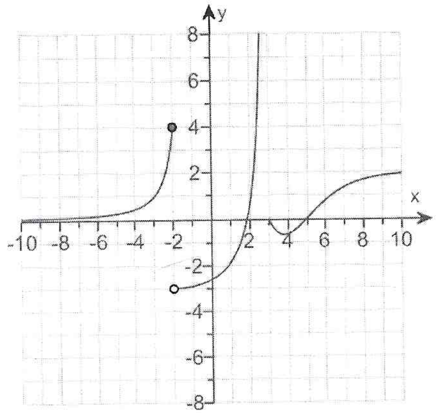
$\Rightarrow 5x^4 + 5y^4\frac{dy}{dx} = 35x\frac{dy}{dx} + 35y$

$\Rightarrow 5y^4\frac{dy}{dx} - 35x\frac{dy}{dx} = 35y - 5x^4$

$\Rightarrow (5y^4 - 35x)\frac{dy}{dx} = 35y - 5x^4$

$\frac{dy}{dx} = \frac{7y - x^4}{y^4 - 7x}$

14. Using the following graph of the function f, evaluate the limits **(a)** through **(i)**.



(a) Select the correct choice below and fill in the answer box within the choice.

- (●) **A.** $\lim_{x \to 5} f(x) =$ 0
- ( ) **B.** $\lim_{x \to 5} f(x)$ does not exist.

(b) $\lim_{x \to -2^+} f(x) =$ -3

(c) $\lim_{x \to -2^-} f(x) =$ 4

(d) Select the correct choice below and fill in the answer box within the choice.

- ( ) **A.** $\lim_{x \to -2} f(x) =$ ______
- (●) **B.** $\lim_{x \to -2} f(x)$ does not exist.

(e) $\lim_{x \to 3^+} f(x) =$ 0

(f) $\lim_{x \to 3^-} f(x) =$ ∞

(g) Select the correct choice below and fill in the answer box within the choice.

- ( ) **A.** $\lim_{x \to 3} f(x) =$ ______
- (●) **B.** $\lim_{x \to 3} f(x)$ does not exist.

(h) $\lim_{x \to \infty} f(x) =$ 2

(i) $\lim_{x \to -\infty} f(x) =$ 0

15. Does the graph of the function below have any horizontal tangents in the interval $0 \le x \le 2\pi$? If so, where? If not, why not? Visualize your findings by graphing the function with a grapher.

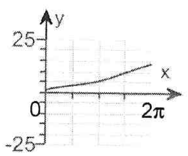
$y = x - 2\sin x$

Select the correct choice below and, if necessary, fill in the answer box to complete your choice.

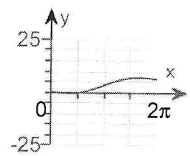
- (selected) **A.** The function has a horizontal tangent at x = $\frac{\pi}{3} + \frac{5\pi}{3}$. $y' = 1 - 2\cos x = 0$ $\cos x = \frac{1}{2}$
  (Type your answer in radians. Type an exact answer in terms of π. Use a comma to separate answers as needed.)
- **B.** The function has no horizontal tangents in the interval $0 \le x \le 2\pi$ because it is never zero in the interval $0 \le x \le 2\pi$.
- **C.** The function has no horizontal tangents in the interval $0 \le x \le 2\pi$ because it is defined at every point in the interval $0 \le x \le 2\pi$.
- **D.** The function has no horizontal tangents in the interval $0 \le x \le 2\pi$ because its derivative is never zero in the interval $0 \le x \le 2\pi$.

Confirm the result visually by graphing $y = x - 2\sin x$. Choose the correct graph below.

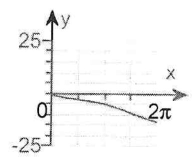
A.



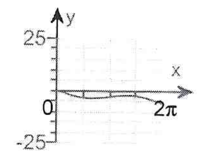
(selected) **B.**



C.



D.



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16. Find the limit.

$$\lim_{x \to 5^+} \frac{3}{x^2 - 25} = \lim_{x \to 5^+} \frac{3}{(x+5)(x-5)} = \infty$$

- **A.** 1
- **B.** $-\infty$
- **C.** ∞
- **D.** 0

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17. Assume that $x = x(t)$ and $y = y(t)$. Let $y = x^3 + 3$ and $\frac{dx}{dt} = 3$ when $x = 1$.

Find $\frac{dy}{dt}$ when $x = 1$.

$\frac{dy}{dt}$ = ____________ (Simplify your answer.)

$$\frac{dy}{dt} = 3x^2 \frac{dx}{dt}$$

$$= 3(1)^2(3)$$

$$\frac{dy}{dt} = 9$$

18. Use logarithmic differentiation to find the derivative of y.

$y = x(x+4)(x+7)$

- A. $\frac{1}{x} + \frac{1}{x+4} + \frac{1}{x+7}$
- B. 1
- C. $x(x+4)(x+7)(\ln x + \ln(x+4) + \ln(x+7))$
- D. $x(x+4)(x+7)\left(\frac{1}{x} + \frac{1}{x+4} + \frac{1}{x+7}\right)$

19. Find an equation for the line tangent to $y = -5 - 6x^2$ at $(-3, -59)$.

The equation for the line tangent to $y = -5 - 6x^2$ at $(-3, -59)$ is y = 36x+49.

20. Find the derivative.

$s = 5t^2 + 8t + 3$

- A. $5t + 8$
- B. $10t + 8$
- C. $10t^2 + 8$
- D. $5t^2 + 8$

21. Use $\lim_{x \to 0} \frac{\sin x}{x} = 1$ to find $\lim_{x \to 0} \frac{\sin 5x}{x}$.

- A. $\frac{1}{5}$
- B. 5
- C. 1
- D. The limit does not exist.

22. Find the limit.

$$\lim_{x \to \infty} \frac{-3x^2 - 2x + 3}{-10x^2 + 8x + 14}$$

- A. 1
- B. $\frac{3}{10}$
- C. $\frac{3}{14}$
- D. ∞

23. At time $t \geq 0$, the velocity of a body moving along the s-axis is $v = t^2 - 6t + 5$. When is the body moving backward?

- A. $t > 5$
- B. $1 < t < 5$
- C. $0 \leq t < 5$
- D. $0 \leq t < 1$

$t^2 - 6t + 5$

$= (t-5)(t-1) = 0$ not moving

$t = 5 \quad t = 1$

v is negative

$t = 0$: $+5$ | $t = 2$: $4 - 12 + 5 = -3$ | $t = 6$: $36 - 36 + 5 = 5$

24. Find the limit.

$$\lim_{x \to \infty} \frac{x^2 + 3x + 17}{x^3 - 7x^2 + 14}$$

- A. $\frac{17}{14}$
- B. ∞
- C. 0
- D. 1

$$\lim_{x \to \infty} \frac{\frac{x^2}{x^2} + \frac{3x}{x^2} + \frac{17}{x^2}}{\frac{x^3}{x^2} - \frac{7x^2}{x^2} + \frac{14}{x^2}} = \lim_{x \to \infty} \frac{1}{x} = 0$$

25. The function $s = f(t)$ gives the position of a body moving on a coordinate line, with s in meters and t in seconds. Find the body's speed and acceleration at the end of the time interval.

$s = 8t - t^2,\ 0 \leq t \leq 8$

- A. 8 m/sec, -2 m/sec^2
- B. 8 m/sec, -16 m/sec^2
- C. -8 m/sec, -2 m/sec^2
- D. 24 m/sec, -16 m/sec^2

Speed $= |v(t)| = \left|\frac{ds}{dt}\right|$

$\left|\frac{ds}{dt}\right| = |8 - 2t|$

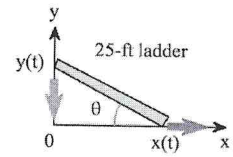
$= |8 - 2(8)|$

$= |8 - 16| = |-8| = +8$

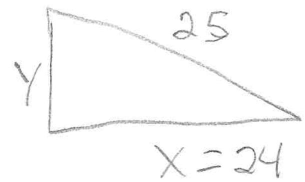
acceleration $= \frac{d^2s}{dt^2} = 8 - 2t$

$= -2$

26. A 25 ft ladder is leaning against a house when its base starts to slide away. By the time the base is 24 ft from the house, the base is moving away at the rate of 7 ft/sec.
What is the rate of change of the height of the top of the ladder?



The rate of change of the height of the top of the ladder is ________ ft/sec.
(Simplify your answer.)



$\frac{dx}{dt} = 7 \frac{ft}{sec}$

$x = 12$

(negative down) $\boxed{\frac{dy}{dt} = -24 \frac{ft}{sec}}$

$x^2 + y^2 = L^2$ $\quad y^2 = 25^2 - 24^2$

$x^2 + y^2 = 25^2$ $\quad y^2 = 49$

$\boxed{y = 7}$

$2x\frac{dx}{dt} + 2y\frac{dy}{dt} = 0$

$2(24)(7) + 2(7)\frac{dy}{dt} = 0$

$336 + 14\frac{dy}{dt} = 0$

$\frac{dy}{dt} = \frac{-336}{14}$

$\frac{dy}{dt} = -24$ ft/sec

1. C. The function is continuous at all x except $x = 2$ and $x = 5$.

2. A. $15x^4 - 52x^3 + 30x^2 + 4x - 16$

3. D. $2x + \frac{2}{x^3}$

4. D. $-\infty$

5. C. 0

6. C. $-5\pi \cos^4(\pi t - 9) \sin(\pi t - 9)$

7. B. $\frac{y}{y - x}$

8. $-\frac{3}{2\sqrt{-7 - 3x}}$

9. C. $\frac{1}{4}$

10. B. $\frac{2}{x}$

11. $\frac{\pi}{6}$

12. $-\frac{2}{x^2} + 9 \cos x$

13. $\frac{7y - x^4}{y^4 - 7x}$

14. A. $\lim_{x \to 5} f(x) =$ **0**

-3

4

B. $\lim_{x \to -2} f(x)$ does not exist.

0

∞

B. $\lim_{x \to 3} f(x)$ does not exist.

2

0

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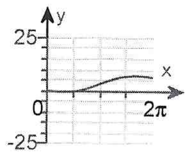
15. A. The function has a horizontal tangent at x = $\frac{5\pi}{3}, \frac{\pi}{3}$.

(Type your answer in radians. Type an exact answer in terms of π. Use a comma to separate answers as needed.)



B.

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16. C. ∞

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17. 9

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18. D. $x(x+4)(x+7)\left(\frac{1}{x} + \frac{1}{x+4} + \frac{1}{x+7}\right)$

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19. $36x + 49$

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20. B. $10t + 8$

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21. B. 5

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22. B. $\frac{3}{10}$

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23. B. $1 < t < 5$

24. C. 0

25. A. 8 m/sec, − 2 m/sec^2

26. −24 ft/sec