Student: ____________________ **Date:** ____________________	**Instructor:** **Course:** Math-1540-W-OL-F18	**Assignment:** Practice Problems for Test 1

1. Find the average rate of change of the function over the given intervals.

   $f(x) = 10x^3 + 10$;   **a**) [4,6],   **b**) [− 5,5]

   a) The average rate of change of the function $f(x) = 10x^3 + 10$ over the interval [4,6] is **760**.
   (Simplify your answer.)

   b) The average rate of change of the function $f(x) = 10x^3 + 10$ over the interval [− 5,5] is **250**.
   (Simplify your answer.)

   ID: 2.1.1

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2. **(a)** Find the slope of the curve $y = x^2 - 4x - 4$ at the point P(3, − 7) by finding the limit of the secant slopes through point P.

   (b) Find an equation of the tangent line to the curve at P(3, − 7).

   (a) The slope of the curve at P(3, − 7) is **2**. (Simplify your answer.)

   (b) The equation of the tangent line to the curve at P(3, − 7) is $y =$ **2x − 13**.

   ID: 2.1.9

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3. Find the following limit.

   $$\lim_{x \to -2} \left(-x^2 + 5x - 4\right)$$

   $\lim_{x \to -2} \left(-x^2 + 5x - 4\right) =$ **− 18** (Simplify your answer.)

   ID: 2.2.12

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4. Find $\lim_{x \to 17} \dfrac{x - 17}{x^2 - 289}$.

   $\lim_{x \to 17} \dfrac{x - 17}{x^2 - 289} =$ $\mathbf{\dfrac{1}{34}}$
   (Type an integer or a simplified fraction.)

   ID: 2.2.23

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5. Find $\lim_{x \to 144} \dfrac{\sqrt{x} - 12}{x - 144}$.

$\lim_{x \to 144} \dfrac{\sqrt{x} - 12}{x - 144} =$ **$\dfrac{1}{24}$**

(Type an integer or a simplified fraction.)

ID: 2.2.35

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6. Find the limit.

$$\lim_{x \to 0} \frac{5 + 4x + \textbf{sin}\, x}{6\, \textbf{cos}\, x}$$

$\lim_{x \to 0} \dfrac{5 + 4x + \textbf{sin}\, x}{6\, \textbf{cos}\, x} =$ **$\dfrac{5}{6}$** (Type an integer or a simplified fraction.)

ID: 2.2.47

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7. Limits of the form $\lim_{h \to 0} \dfrac{f(x+h) - f(x)}{h}$ occur frequently in calculus. Evaluate this limit for the given value of x and function f.

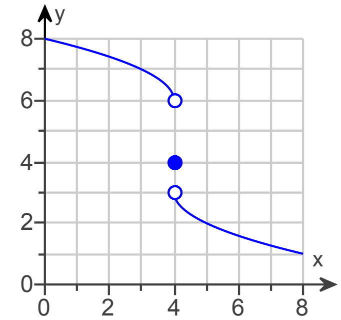
$f(x) = x^2, \quad x = -8$

The value of the limit is **-16**. (Simplify your answer.)

ID: 2.2.57

8.

For the function graphed to the right, explain why $\lim_{x \to 4} f(x) \neq 3$.



Choose the correct reason below.

- ○ **A.** The limit of f(x) as x approaches 4 is 4.
- ○ **B.** The limit of f(x) as x approaches 4 is $\frac{9}{2}$.
- ◉ **C. The limit of f(x) as x approaches 4 does not exist.**
- ○ **D.** The limit of f(x) as x approaches 4 is 6.

ID: 2.3.59

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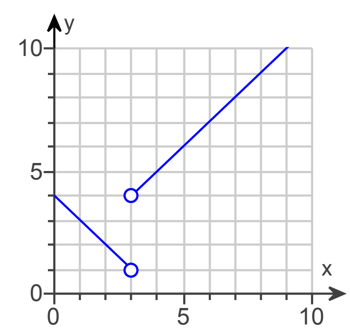
9. Use the following function and its graph to answer (a) through (d) below.

$$\text{Let } f(x) = \begin{cases} 4 - x, & x < 3 \\ x + 1, & x > 3. \end{cases}$$



a. Find $\lim_{x \to 3^+} f(x)$ and $\lim_{x \to 3^-} f(x)$. Select the correct choice below and fill in any answer boxes in your choice.

- ◉ **A.** $\lim_{x \to 3^+} f(x) = \underline{\quad 4 \quad}$, $\lim_{x \to 3^-} f(x) = \underline{\quad 1 \quad}$ **(Simplify your answer.)**
- ○ **B.** The limit does not exist.

b. Does $\lim_{x \to 3} f(x)$ exist? If so, what is it? If not, why not?

- ◉ **A. No, $\lim_{x \to 3} f(x)$ does not exist because $\lim_{x \to 3^+} f(x) \neq \lim_{x \to 3^-} f(x)$.**
- ○ **B.** No, $\lim_{x \to 3} f(x)$ does not exist because f(3) is undefined.
- ○ **C.** Yes, $\lim_{x \to 3} f(x)$ exists and equals 1.
- ○ **D.**

Yes, $\lim_{x \to 4} f(x)$ exists and equals 4.

c. Find $\lim_{x \to 4^+} f(x)$ and $\lim_{x \to 4^-} f(x)$. Select the correct choice below and fill in any answer boxes in your choice.

◉ **A.** $\lim_{x \to 4^+} f(x) =$ **5**, $\lim_{x \to 4^-} f(x) =$ **5** **(Simplify your answer.)**

○ **B.** The limit does not exist.

d. Does $\lim_{x \to 4} f(x)$ exist? If so, what is it? If not, why not?

○ **A.** No, $\lim_{x \to 4} f(x)$ does not exist because f(4) is undefined.

◉ **B. Yes, $\lim_{x \to 4} f(x)$ exists and equals 5.**

○ **C.** No, $\lim_{x \to 4} f(x)$ does not exist because $\lim_{x \to 4^+} f(x) \neq \lim_{x \to 4^-} f(x)$.

○ **D.** Yes, $\lim_{x \to 4} f(x)$ exists and equals 0.

ID: 2.4.3

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10. Use the relation $\lim_{\theta \to 0} \frac{\sin \theta}{\theta} = 1$ to determine the limit.

$$\lim_{\theta \to 0} \frac{\sin \sqrt{5}\,\theta}{\sqrt{5}\,\theta}$$

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

◉ **A.** $\lim_{\theta \to 0} \frac{\sin \sqrt{5}\,\theta}{\sqrt{5}\,\theta} =$ **1** **(Type an integer or a simplified fraction.)**

○ **B.** The limit does not exist.

ID: 2.4.21

11. Find the following limit.

$$\lim_{\theta \to \frac{\pi}{2}} \theta \cos \theta$$

Select the correct choice below and fill in any answer boxes within your choice.

- (●) **A.** **$\lim_{\theta \to \frac{\pi}{2}} \theta \cos \theta =$ 0 (Type an exact answer, using π as needed.)**
- ( ) **B.** The limit does not exist.

ID: 2.4.37

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12. Once you know $\lim_{x \to a^+} f(x)$ and $\lim_{x \to a^-} f(x)$ at an interior point of the domain of f, do you then know $\lim_{x \to a} f(x)$? Give reasons for your answer.

Choose the correct answer below.

- ( ) **A.** If the side limits are equal to each other, then $\lim_{x \to a} f(x)$ exists and it equals the common value of the side limits. If the side limits are not equal to each other, then $\lim_{x \to a} f(x)$ equals to the larger limit.
- (●) **B.** **If the side limits are equal to each other, then $\lim_{x \to a} f(x)$ exists and it equals the common value of the side limits. If the side limits are not equal to each other, then $\lim_{x \to a} f(x)$ does not exist.**
- ( ) **C.** Nothing can be said about $\lim_{x \to a} f(x)$.

ID: 2.4.43

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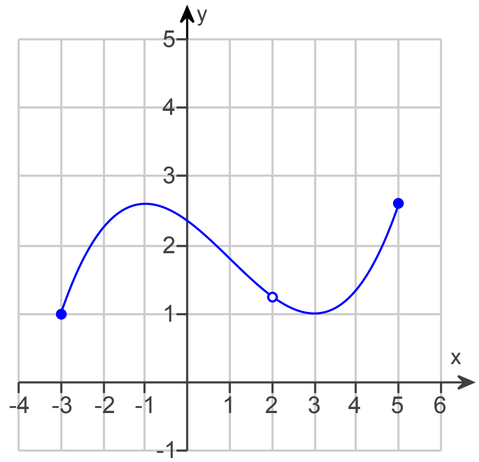
13. Say whether the function graph below is continuous on $[-3,5]$. If not, where does it fail to be continuous?



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

◉ **A. The graph is not continuous at $x =$ 2 .**
(Use a comma to separate answers as needed.)

○ **B.** The graph is not continuous on the interval ______ .
(Type your answer in interval notation.)

○ **C.** The graph is continuous on $[-3,5]$.

ID: 2.5.1

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14. Use the function and the accompanying figure to answer the following questions.

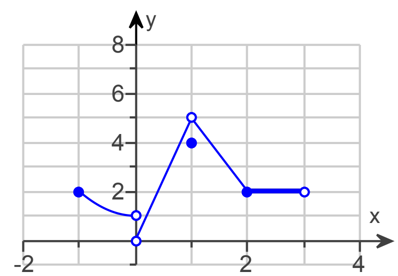
a. Is f defined at $x = 2$?

◉ **Yes**
○ No

b. Is f continuous at $x = 2$?

◉ **Yes**
○ No

$$f(x) = \begin{cases} x^2 - 1, & -1 \le x < 0 \\ 5x, & 0 < x < 1 \\ 4, & x = 1 \\ -3x + 8, & 1 < x < 2 \\ 2, & 2 \le x < 3 \end{cases}$$



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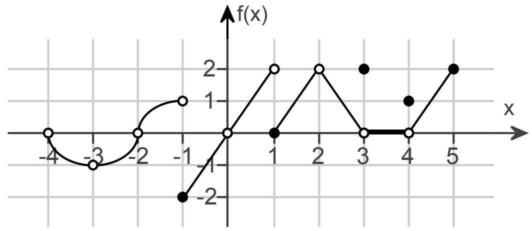
15.

Use the graph to answer the question about discontinuity.



Select the correct description of the continuity of f(x) at x = 5.

- (selected) **A. The function is continuous.**
- B. There is a non-removable discontinuity because f(5) = f(x) for other values of x in the domain of f(x).
- C. The function has a non-removable discontinuity.

ID: 2.5.11

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16. Find the limit of the rational function **a.** as $x \to \infty$ and **b.** as $x \to -\infty$.

$$h(x) = \frac{19x^4}{3x^4 + 15x^3 + 14x^2}$$

a. $\lim_{x \to \infty} \frac{19x^4}{3x^4 + 15x^3 + 14x^2} = \mathbf{\frac{19}{3}}$ (Simplify your answer.)

b. $\lim_{x \to -\infty} \frac{19x^4}{3x^4 + 15x^3 + 14x^2} = \mathbf{\frac{19}{3}}$ (Simplify your answer.)

ID: 2.6.17

17.

Find the limit of $f(x) = \frac{4x^4 + 6x^3 + 9}{7x^5}$ as x approaches ∞ and as x approaches $-\infty$.

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

(Simplify your answer.)

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

(Simplify your answer.)

ID: 2.6.19

18. Find $\lim_{x\to\infty} \sqrt[3]{\frac{1+8x^2}{x^2+9}}$.

$\lim_{x\to\infty} \sqrt[3]{\frac{1+8x^2}{x^2+9}}$ = **2** (Simplify your answer.)

ID: 2.6.23

19. Find the following limit.

$$\lim_{x\to\infty} \frac{\sqrt{x^4+4}}{2x^2+1}$$

$\lim_{x\to\infty} \frac{\sqrt{x^4+4}}{2x^2+1}$ = $\mathbf{\frac{1}{2}}$ (Simplify your answer.)

ID: 2.6.33

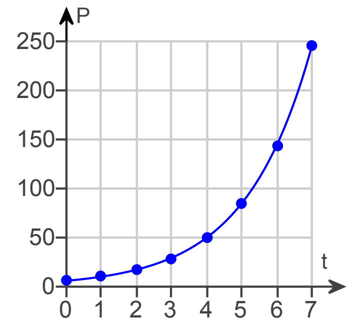
20. Find the limit.

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

$\lim_{x\to 3^+} \frac{3}{x-3}$ = $\boldsymbol{\infty}$ (Simplify your answer.)

ID: 2.6.40

21. In a controlled laboratory experiment, yeast cells are grown in an automated cell culture system that counts the number P of cells present at hourly intervals. The number after t hours is shown in the accompanying figure. Complete parts (a) through (c) below.



a. Explain what is meant by the derivative $P'(5)$. What are its units?

Choose the correct answer below.

- **A.** The derivative $P'(5)$ represents the average rate of change of the number of cells from $t = 0$ to $t = 5$.
- **B.** The derivative $P'(5)$ represents the average number of cells from $t = 0$ to $t = 5$.
- **C. The derivative $P'(5)$ represents the rate of change of the number of cells at $t = 5$.**
- **D.** The derivative $P'(5)$ represents the number of cells at $t = 5$.

The units of the derivative $P'(5)$ are (1) ______________

b. Which is larger, $P'(1)$ or $P'(4)$? Give a reason for your answer.

- **A.** $P'(1)$ is larger, because the value of $P(t)$ is greater at $t = 1$ than at $t = 4$.
- **B. $P'(4)$ is larger, because the slope of the graph of $P(t)$ is greater at $t = 4$ than at $t = 1$.**
- **C.** $P'(4)$ is larger, because the value of $P(t)$ is greater at $t = 4$ than at $t = 1$.
- **D.** $P'(1)$ is larger, because the slope of the graph of $P(t)$ is greater at $t = 1$ than at $t = 4$.

c. The quadratic curve capturing the trend of the data points is given by $P(t) = 7.20t^2 - 19.85t + 16.67$. Find the instantaneous rate of growth when $t = 5$ hours.

The instantaneous rate of growth is **52.15** (2) ______________

(Round to two decimal places as needed.)

(1)
- the number of hours.
- the number of cells per hour squared.
- **the number of cells per hour.**
- the number of cells.

(2)
- $\frac{\text{cells}}{\text{hour}^2}$.
- **$\frac{\text{cells}}{\text{hour}}$.**
- cells.
- hours.

ID: 3.1.23

22. At t sec after liftoff, the height of a rocket is $3t^2$ft. How fast is the rocket climbing 7 sec after the liftoff?

The speed of the rocket 7 seconds after liftoff is **42** ft/sec.
(Simplify your answer.)

ID: 3.1.30

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23. Find the indicated derivative.

$\frac{dy}{dx}$ if $y = -2x^{3/2}$

$\frac{dy}{dx} =$ $\mathbf{-3x^{\frac{1}{2}}}$

ID: 3.2.11

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24. Differentiate the function and find the slope of the tangent line at the given value of the independent variable.

$s = -4t^4 - 2t^3, \quad t = -1$

- **A.** -10
- **B.** 22
- **C.** **10** (selected)
- **D.** -22

ID: 3.2-15

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25. Find the derivative.

$y = 14x^{-2} + 5x^3 - 2x$

- **A.** $\mathbf{-28x^{-3} + 15x^2 - 2}$ (selected)
- **B.** $-28x^{-1} + 15x^2 - 2$
- **C.** $-28x^{-3} + 15x^2$
- **D.** $-28x^{-1} + 15x^2$

ID: 3.3-4

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26. Find the second derivative.

$y = 4x^2 + 8x + 4x^{-3}$

- A. $8 - 48x^{-5}$
- B. $8x + 8 - 12x^{-4}$
- C. $8 + 48x^{-1}$
- D. **$8 + 48x^{-5}$**

ID: 3.3-12

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27. Find y′.

$y = (3x^3 + 3)(3x^7 - 9)$

- A. $90x^9 + 63x^6 - 81x$
- B. $12x^9 + 63x^6 - 81x$
- C. $12x^9 + 63x^6 - 81x^2$
- D. **$90x^9 + 63x^6 - 81x^2$**

ID: 3.3-18

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28. Find the derivative of the function.

$$y = \frac{x^2 - 3x + 2}{x^7 - 2}$$

- A. **$y' = \dfrac{-5x^8 + 18x^7 - 14x^6 - 4x + 6}{(x^7 - 2)^2}$**
- B. $y' = \dfrac{-5x^8 + 18x^7 - 14x^6 - 3x + 6}{(x^7 - 2)^2}$
- C. $y' = \dfrac{-5x^8 + 19x^7 - 14x^6 - 4x + 6}{(x^7 - 2)^2}$
- D. $y' = \dfrac{-5x^8 + 18x^7 - 13x^6 - 4x + 6}{(x^7 - 2)^2}$

ID: 3.3-22

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29. Find the derivative.

$w = z^{5-e}$

- ○ **A.** $\frac{z^{6-e}}{6-e}$
- ○ **B.** $(4-e)z^{5-e}$
- ○ **C.** z^{5-e}
- ◉ **D.** $\mathbf{(5-e)z^{4-e}}$

ID: 3.3-31

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30. Find the first and second derivatives.

$y = -9x^6 + 1$

$\frac{dy}{dx} = \mathbf{-54x^5}$

$\frac{d^2y}{dx^2} = \mathbf{-270x^4}$

ID: 3.3.1