

WORKSHEET ON LIMITS

Name: _____ Discussion Section Number: _____

1. TANGENT AND VELOCITY (2.1)

The displacement (in meters) of an object moving in a straight line is given by

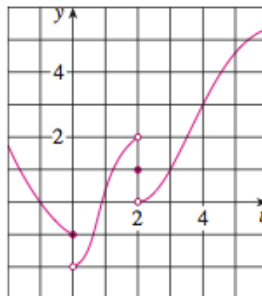
$$s = 1 + 2t + \frac{1}{4}t^2,$$

where t is measured in seconds.

- (1) Find the average velocity over each time period.
 - $[1, 3]$
 - $[1, 2]$
 - $[1, 1.5]$
 - $[1, 1.1]$
- (2) Find the instantaneous velocity at time $t = 1$.

2. THE LIMIT OF A FUNCTION (2.2)

- (1) Based on the graph of $y = g(t)$ below, state the value of each limit if it exists. If it does not exist, explain why.



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|-------------------------------------|-------------------------------------|-------------------------------------|
| (a) $\lim_{t \rightarrow 0^-} g(t)$ | (e) $\lim_{t \rightarrow 2^-} g(t)$ | (i) $\lim_{t \rightarrow 4^-} g(t)$ |
| (b) $\lim_{t \rightarrow 0^+} g(t)$ | (f) $\lim_{t \rightarrow 2^+} g(t)$ | (j) $\lim_{t \rightarrow 4^+} g(t)$ |
| (c) $\lim_{t \rightarrow 0} g(t)$ | (g) $\lim_{t \rightarrow 2} g(t)$ | (k) $\lim_{t \rightarrow 4} g(t)$ |
| (d) $g(0)$ | (h) $g(2)$ | (l) $g(4)$ |

- (2) Determine whether the following limits are ∞ or $-\infty$.

(a) $\lim_{x \rightarrow 3^-} \frac{x+2}{(x-3)^3}$	(b) $\lim_{x \rightarrow 5^-} \frac{\sqrt{x}}{(x-5)^2}$
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3. CALCULATING LIMITS USING THE LIMIT LAWS (2.3)

(1) Evaluate the limit if it exists.

$$(a) \lim_{x \rightarrow 1} \frac{x^2 + 4x}{x^2 + 3x - 4} \qquad (b) \lim_{x \rightarrow -4} \frac{\sqrt{x^2 + 9} - 5}{x + 4}$$

(2) Evaluate the limit in terms of a , if the limit exists.

$$(a) \lim_{t \rightarrow 0} \frac{\sqrt{a+t} - \sqrt{a-t}}{t} \qquad (b) \lim_{h \rightarrow 0} \frac{1/(a+h)^2 - 1/a^2}{h}$$

4. CONTINUITY (2.5)

(1) Determine the value of the constant a for which the function

$$f(x) = \begin{cases} \frac{x^2 - 3x + 2}{x - 1} & \text{if } x \neq 1, \\ a & \text{if } x = 1 \end{cases}$$

is continuous at 1.

(2) Let

$$g(x) = \begin{cases} x^2 + x & \text{if } x < 1, \\ a & \text{if } x = 1, \\ 3x + 5 & \text{if } x > 1. \end{cases}$$

- (a) Determine the value of a for which g is continuous from the left at 1.
 (b) Determine the value of a for which g is continuous from the right at 1.
 (c) Is there a value of a for which g is continuous at 1? Explain.

5. LIMITS AT INFINITY; HORIZONTAL ASYMPTOTES (2.6)

Find the limit in each case or explain why it does not exist.

$$(1) \lim_{x \rightarrow \infty} \frac{x^2}{\sqrt{6x^4 - 1}} \qquad (3) \lim_{x \rightarrow \infty} x + \sqrt{x^2 + 2x}$$

$$(2) \lim_{x \rightarrow \infty} \frac{100000x}{x^3 + x} \qquad (4) \lim_{x \rightarrow \infty} \frac{e^{3x} - e^{-3x}}{e^{3x} + e^{-3x}}$$