

# Limits, Continuity & Derivatives

## Chapter 1, 2, 3 & 4 Review II

Find the limits by using any method. Then, circle which method you used.

#1)  $\lim_{x \rightarrow 9} \frac{\frac{1}{3x} - 4}{2x - 18}$

Graphing

Table

Substitution

#2)  $\lim_{x \rightarrow -2} \frac{x^2 + 4x + 4}{x^2 + 2x}$

Graphing

Table

Substitution

#3)  $\lim_{x \rightarrow 2} (x^2 - 4x + 9)$

Graphing

Table

Substitution

#4)  $\lim_{x \rightarrow 6} \frac{2x^2 - 15x + 18}{x^2 - 6x}$

Graphing

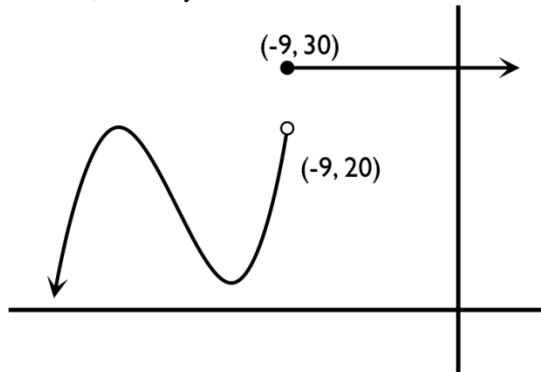
Table

Substitution

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#5) Use the graph of the piecewise function to state each of the limits. Then decide if the function is continuous at  $x = -9$ . If not, state why.

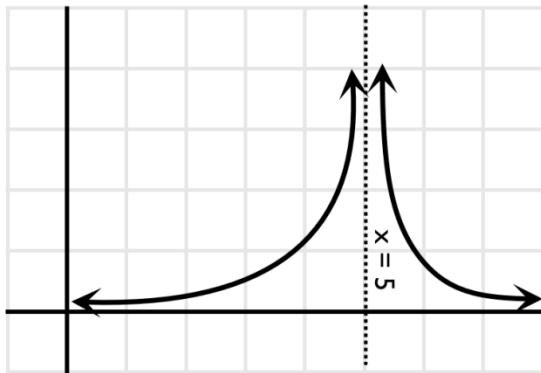


- $\lim_{x \rightarrow -9^-} f(x) =$
- $\lim_{x \rightarrow -9^+} f(x) =$
- $\lim_{x \rightarrow -9} f(x) =$
- Is the function continuous at  $x = -9$ ? If not, why not?

#7) Find  $f'(x)$  by using the definition of the derivative.

$$f(x) = \frac{2}{x-2}$$

#6) Use the graph to state the limit.



$$\lim_{x \rightarrow 5} f(x) =$$

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## Chapter 1, 2, 3 & 4 Review II

#8) Find the equation for the tangent line to the curve  $f(x) = 2x^2 - x + 11$  at  $x = -3$ . Write the answer in slope-intercept form.

#9) If  $h(x) = (x^2 + 2x)(2x + 1)$  find  $\frac{dh}{dx}$ .

Limits, Continuity & Derivatives  
Chapter 1, 2, 3 & 4 Review II

#10) If  $f(x) = \frac{x^4 + x^2 + 1}{x^2 + 1}$  find  $\frac{df}{dx} \Big|_{x=-2}$

#11) If  $h(x) = 6x^7 - 8x^4 + 4$  find  $\frac{d^2h}{dx^2}$

Limits, Continuity & Derivatives  
Chapter 1, 2, 3 & 4 Review II

#12) If  $f(x) = \frac{5}{x^6}$  find  $f''(x)$

#14) If  $g(x) = \frac{1}{\sqrt[3]{(3x-1)^2}}$  find  $g'(x)$

#13) If  $h(x) = (3x^2 + 5x + 2)^4$  find  $h'(x)$

Limits, Continuity & Derivatives  
Chapter 1, 2, 3 & 4 Review II

#15) If  $k(x) = 3x^2(2x + 1)^5$  find  $k'(x)$

#16) If  $w(x) = \left(\frac{x-1}{x+1}\right)^5$  find  $w'(x)$

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## Chapter 1, 2, 3 & 4 Review II

#17) While in flight on his rocket, George has another brilliant idea: he wants to sell tweezers to lumberjacks. Shortly after, he blacks out. During his comatose state, he has a vision consisting of a midget Happy Gilmore riding a tricycle on the beach. Happy looks at George and says, "Your cost function is  $C(x) = \sqrt{4x^2 + 900}$  dollars, where  $x$  is the number of tweezers produced."

- a. Find the marginal cost function:

$$MC(x) =$$

- b. Evaluate the marginal cost function at 30 and interpret this answer.

$$MC(30) =$$

Interpretation =

#18) An unconscious George laments his social status. A person's social status (rated on a scale where 100 indicates the status of a college graduate) depends on years of education. A person with  $e$  years of education has a social status of  $S(e) = 0.22(e + 4)^{2.1}$ . George's highest level of education is 4th grade.

Find the instantaneous rate of change of George's social status at 2<sup>nd</sup> grade and interpret this answer.

$$S'(2) =$$

Interpretation =

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## Chapter 1, 2, 3 & 4 Review II

#19) As the rocket continues to rise George gets colder and colder. On this particular day, the temperature of the atmosphere  $t$  miles from the earth's crust is  $T(t) = 65 - \frac{t^2}{4}$  (for  $t \geq 16$ ).

- a. Find  $T'(10)$  and interpret this answer.

$$T'(10) =$$

Interpretation =

- b. Find  $T''(10)$  and interpret this answer.

$$T''(10) =$$

Interpretation =

#20) When the rocket finally crashes and all the dust settles, it does so in Fairbanks, Alaska. Not wanting to make the same mistake he made earlier, George stows away on a train traveling *west*. After  $t$  hours George is  $s(t) = 24t^2 - 2t^3$  miles due west of his starting point (for  $0 \leq t \leq 12$ ).

- a. Find the train's velocity at time  $t = 4$  hours. Write your answer as a sentence.

- b. Find the train's velocity at time  $t = 10$  hours. Write your answer as a sentence.

- c. Find the train's acceleration at time  $t = 1$  hours. Write your answer as a sentence.



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#21) While on the train George finds a marble. Not just any marble. This is the same marble that caused George's parents to divorce. After a long fight, filled with hurtful words and explosive blows, George finally gets the upper hand in the heated battle. With all his might, he is able to push the marble out of the train while on Cushman Street Bridge. The height above the water  $t$  seconds after the marble is discarded is  $s(t) = 128 - 16t^2$  feet (neglecting air resistance).

- a. How long will it take to hit the water? Use a sentence answer.

- b. With what velocity will the marble hit the water? Use a sentence answer.

#22) When the train stops, George runs over to the sandy beach with unbridled excitement. He finally made it to California, or so he *thought*. When he hears a woman yell, "I can see Russia from my house," he realizes he is in fact not in California, but Alaska. He swiftly commandeers a Hummer and heads southeast. After  $t$  hours George is a distance  $s(t) = 60t + \frac{100}{t+3}$  miles from his starting point.

- a. Find the velocity after 2 hours. Use a sentence answer.

- b. Find the acceleration after 2 hours. Use a sentence answer.

Limits, Continuity & Derivatives  
Chapter 1, 2, 3 & 4 Review II

$$\#23) \frac{d}{dx} [\csc(x) \cos(x)]$$

$$\#25) \frac{d}{dx} [\sin^3(5x) + \cos^2(5x)]$$

$$\#24) \frac{d}{dx} \left[ \frac{\tan^2(x) + \sin^2(x) + \cos^2(x)}{\frac{1}{\cos^2(x)}} \right]$$

$$\#26) \frac{d}{dx} [\cos(\sin(x^2))]$$