MA 133 Test Chapter 2

Multiple Choice

~~For numbers 1-10 only you may use your calculator.~~ ***Do not write on this test.***

Indicate the answer choice that best completes the statement or answers the question.

1. Find the derivative of the function using the definition of derivative.

$g(t) = \dfrac{1}{\sqrt{6t}}$

a. $g'(t) = -\dfrac{1}{2\sqrt{6t^3}}$

b. $g'(t) = \dfrac{1}{2\sqrt{6t^3}}$

c. $g'(t) = -\dfrac{1}{\sqrt{216t^3}}$

d. $g'(t) = \sqrt{6t}$

2. The point $P(1, 3)$ lies on the curve $y = \dfrac{3}{x^2}$. Estimate the value of the slope of the tangent line to the curve at $P(1, 3)$.

a. –6

b. –9

c. 3

d. 12

3. If a rock is thrown upward on the planet Pluto with a velocity of 30 m/s, its height in meters t seconds later is given by $y = 30t - 0.34t^2$. Find the average velocity over the time interval $[2, 2.5]$. Round your answer to 1 decimal place if necessary.

a. 58.5

b. 7.1

c. 28.5

d. –14.2

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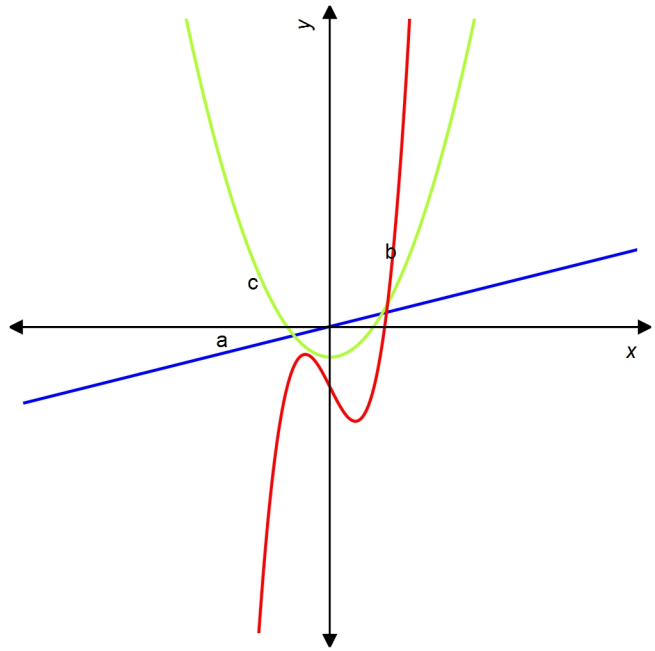
4. The figure shows graphs of f, f', and f''. Identify each curve.



a. a $= f''$, b $= f$, c $= f'$

b. a $= f''$, b $= f'$, c $= f$

c. a $= f'$, b $= f''$, c $= f$

d. a $= f$, b $= f'$, c $= f''$

5. If $\lim_{x \to 2^+} f(x) = 5.9$, then if $\lim_{x \to 2} f(x)$ exists, to what value does it converge?

a. 6.9

b. 5.9

c. 4.9

d. 3.9

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6. Let N represent the number of houses in a small community t years after January 1, 2010. Interpret the statement $\left.\frac{dN}{dt}\right|_{t=4} = 2$.

   a. There were four houses built in 2012.

   b. On January 1, 2014, there were two houses remaining in the community.

   c. On January 1, 2014, the number of houses was increasing at a rate of two houses per year.

   d. On January 1, 2012, the number of houses was increasing at a rate of four houses per year.

7. The data below shows Usain Bolt's position during his gold medal winning 100-meter sprint at the 2008 summer Olympics. Find his average velocity between the 40 m and 70 m marks.

t (seconds)	1.85	2.87	3.78	4.65	5.50	6.32	7.14	7.96	8.79	9.69
s (meters)	10	20	30	40	50	60	70	80	90	100

   a. 8.93 m/s

   b. 12.05 m/s

   c. 9.06 m/s

   d. 7.18 m/s

8. Find the limit.

$$\lim_{t \to \infty} \frac{t^2 + 3}{t^3 + t^2 - 4}$$

   a. 0

   b. 3

   c. 4

   d. – 3

9. Evaluate the limit.

$$\lim_{x \to \infty} \frac{3 - \cos x}{x^2 + x}$$

   a. 1

   b. π

   c. 0

   d. ∞

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10. Find the limit.

$$\lim_{x \to \infty} \frac{\sqrt{x^2 - 49}}{4x - 12}$$

a. 12

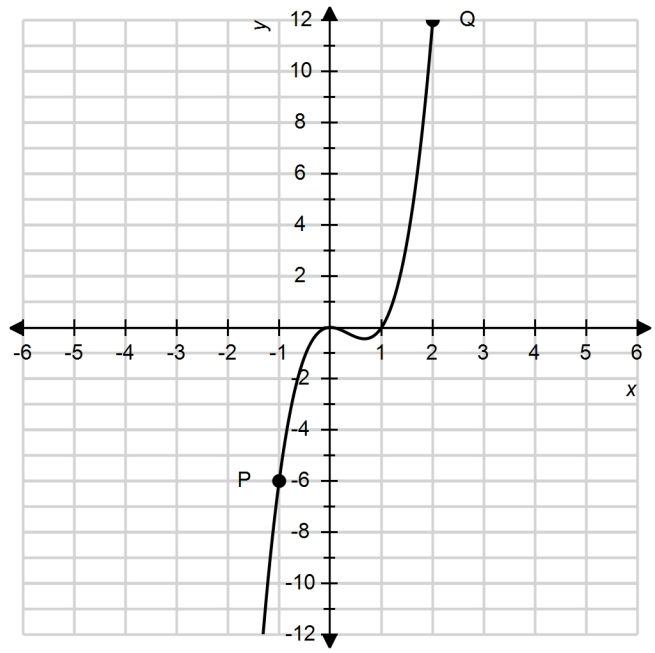
b. –7

c. 7

d. $\frac{1}{4}$

e. does not exist

11. Using the graph below, find the slope of the secant line PQ.



a. 18

b. –1

c. 2

d. 6

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12. The point $P(0.5, 1)$ lies on the curve $y = \sin(\pi x)$. If Q is the point $(x, \sin(\pi x))$ use your calculator to find the slope of the secant line PQ (correct to six decimal places) for the value $x = 0.7$.

    a. –0.038197
    b. 0.809017
    c. –1.047214
    d. –0.954915

13. The flash unit on a camera operates by storing charge on a capacitor and releasing it suddenly when the flash is set off. The data in the table describe the charge Q remaining on the capacitor at time t (measured in seconds after the flash goes off). Use the data to estimate the electric current flowing from the capacitor to the flash bulb when $t = 0.06$. Note: The slope of the tangent line represents the electric current flowing from the capacitor to the flash bulb (measured in microamperes).

t (seconds)	0.00	0.02	0.04	0.06	0.08	0.10
Q (microcoulombs)	80.00	65.50	54.63	44.70	32.15	27.41

    a. 1124 μA
    b. –432.25 μA
    c. –520 μA
    d. –562 μA

14. Find the derivative of the function using the definition of derivative.

    $f(x) = -14x + 3$

    a. $f'(x) = -28x$
    b. $f'(x) = -14$
    c. $f'(x) = 3$
    d. $f'(x) = -14x$

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15. Find the limit $\lim_{x \to -3} \frac{x^2 + 5x + 6}{x + 3}$, if it exists.

a. 2
b. Does not exist
c. –3
d. –1

16. ~~**You must now remove the calculator from your desk.**~~

If the tangent line to $y = f(x)$ at (8, 4) passes through the point (4, –34), find $f'(8)$.

a. $f'(8) = 29.5$
b. $f'(8) = 9.5$
c. $f'(8) = 19.5$
d. $f'(8) = 34.5$

Numeric Response
Enter the appropriate value to answer the question or solve the problem.

17. Find the limit.

$$\lim_{t \to 5} \frac{t^2 - 25}{t^3 - 125}$$

18. Find a function g that agrees with f for $x \neq 25$ and is continuous on $\mathbb{R}$.

$$f(x) = \frac{5 - \sqrt{x}}{25 - x}$$

19. BONUS: How close to 2 do we have to take x so that $5x + 3$ is within a distance of 0.01 from 13?

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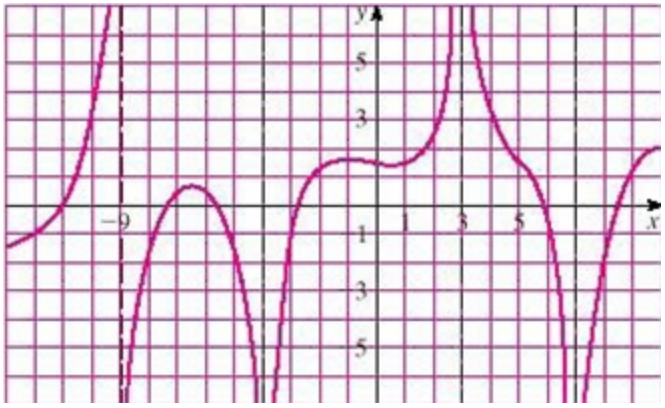
20. For the function *f* whose graph is shown, state the following.

$$\lim_{x \to -4} f(x)$$



21. Find the limit.

$$\lim_{y \to \infty} \frac{9-5y^2}{9y^2+5y}$$

22. For the function f whose graph is given, find the limit.

$$\lim_{x \to -1^-} f(x)$$

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23. Find $f'(a)$.

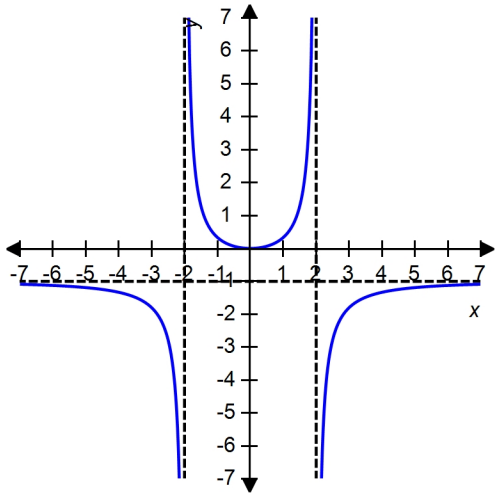
$f(x) = 14 + x - 7x^2$

24. If f and g are continuous functions with $f(5) = 2$ and $\lim_{x \to 5}[2f(x) - g(x)] = 5$, find $g(5)$.

25. Write an equation that expresses the fact that a function f is continuous at the number 7.

Subjective Short Answer

26. You are given the graph of f. Find the horizontal and vertical asymptotes of the graph of f.



27. Find the limit $\lim_{x \to -4} \dfrac{x^2+x-12}{x^2-16}$, if it exists.

28. Show that the function is continuous but not differentiable at the given value of x.

$\begin{cases} x+9 & \text{if } x < 0 \\ x^2+9 & \text{if } x \geq 0 \end{cases}$; $x = 0$

29. Find the limit $\lim_{x \to 0^+} \dfrac{9+\sqrt{x}}{\sqrt{x+64}}$.

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Answer Key

1. a

2. a

3. c

4. c

5. b

6. c

7. b

8. a

9. c

10. d

11. d

12. d

13. d

14. b

15. d

16. b

17. $\frac{2}{15}$

18. $g(x) = \frac{1}{5 + \sqrt{x}}$

19. $|x - 2| < 0.002$

20. $-\infty$

21. $-\frac{5}{9}$

22. $+\infty$

23. 1–14*a*

24. –1

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25. $\lim_{x \to 7} f(x) = f(7)$

26. HA $y = -1$, VA $x = -2, 2$

27. $\frac{7}{8}$

28. $f(x)$ is continuous at 0 since both $\lim_{x \to 0-} f(x) = \lim_{x \to 0^-} x + 9 = 9$ and $\lim_{x \to 0^+} f(x) = \lim_{x \to 0^+} x^2 + 9 = 9$ are equal to $f(0) = 9$.

$f(x)$ is not differentiable at 0 since the left-hand limit of the quotient $\frac{f(0+h) - f(0)}{h}$ does not equal its right-hand limit as shown below.

$$\lim_{h \to 0^-} \frac{f(0+h) - f(0)}{h} = \lim_{h \to 0^-} \frac{f(h) - f(0)}{h} = \lim_{h \to 0^-} \frac{(h+9) - (9)}{h} = \lim_{h \to 0^-} \frac{h}{h} = \lim_{h \to 0^-} 1 = 1 \ (x < 0)$$

$$\lim_{h \to 0+} \frac{f(0+h) - f(0)}{h} = \lim_{h \to 0+} \frac{f(h) - f(0)}{h} = \lim_{h \to 0^+} \frac{(h^2+9) - (9)}{h} = \lim_{h \to 0^+} \frac{h^2}{h} = \lim_{h \to 0^+} h = 0 \ (x > 0)$$

29. $\frac{9}{8}$