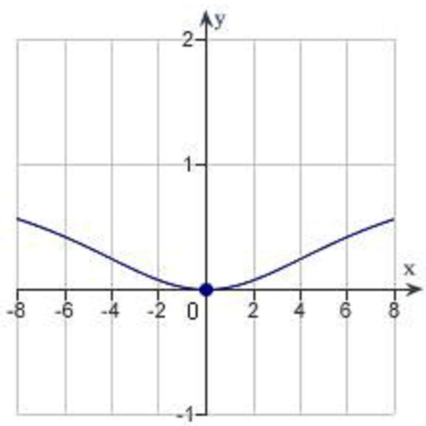
Name: ________________________ **Class:** ___________________ **Date:** __________ **ID: A**

Ch 3 Practice

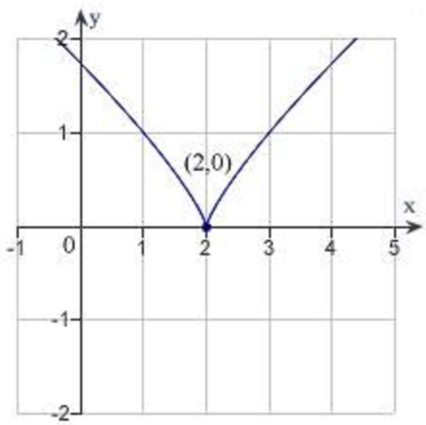
Multiple Choice
Identify the choice that best completes the statement or answers the question.

____ 1. Find the value of the derivative (if it exists) of the function $f(x) = \dfrac{x^2}{x^2 + 49}$ at the extremum point $(0,0)$.



a. $\dfrac{1}{8}$
b. $-\dfrac{1}{8}$
c. -1
d. 0
e. 1

____ 2. Find the value of the derivative (if it exists) of $f(x) = (x-2)^{4/5}$ at the indicated extremum.



a. $f\,'(2)$ is undefined.
b. $f\,'(2) = (-4)^{4/5}$
c. $f\,'(2) = 0$
d. $f\,'(2) = \dfrac{4}{5}(2)^{-1/5}$
e. $f\,'(2) = (4)^{4/5}$

____ 3. Find all critical numbers of the function $g(x) = x^4 - 4x^2$.

a. critical numbers: $x = 0$, $x = 2\sqrt{2}, x = -2\sqrt{2}$
b. critical numbers: $x = 0$, $x = \sqrt{2}, x = -\sqrt{2}$
c. critical numbers: $x = 2\sqrt{2}$, $x = -2\sqrt{2}$
d. critical numbers: $x = \sqrt{2}, x = -\sqrt{2}$
e. no critical numbers

____ 4. Locate the absolute extrema of the function $g(x) = \dfrac{4x+5}{5}$ on the closed interval $[0, 5]$.

a. absolute maximum: $(5, 5)$
   absolute minimum: $(0, 0)$
b. absolute maximum: $(5, 1)$
   absolute minimum: (0, 5)
c. absolute maximum: $(5, 5)$
   absolute minimum: $(0, 1)$
d. absolute maximum: $(5, 5)$
   absolute minimum: $(1, 0)$
e. absolute maximum: $(0, 5)$
   absolute minimum: $(1, 0)$

____ 5. Locate the absolute extrema of the function $f(x) = x^3 - 12x$ on the closed interval $[0, 4]$.

a. absolute max: $(2, -16)$; absolute min: $(4, 16)$
b. no absolute max; absolute min: $(4, 16)$
c. absolute max: $(4, 16)$; absolute min: $(2, -16)$
d. absolute max: $(4, 16)$; no absolute min
e. no absolute max or min

____ 6. Locate the absolute extrema of the function $f(x) = \sin \pi x$ on the closed interval $\left[0, \frac{1}{3}\right]$.

a. The absolute minimum is 0, and it occurs at the left endpoint $x = 0$.
The absolute maximum is $\frac{\sqrt{3}}{2}$, and it occurs at the right endpoint $x = \frac{1}{3}$.
b. The absolute minimum is 0, and it occurs at the right endpoint $x = \frac{1}{3}$.
The absolute maximum is $\frac{1}{2}$, and it occurs at the left endpoint $x = 0$.
c. The absolute minimum is 0, and it occurs at the left endpoint $x = 0$.
The absolute maximum is $\frac{1}{2}$, and it occurs at the right endpoint $x = \frac{1}{3}$.
d. The absolute minimum is 0, and it occurs at the right endpoint $x = \frac{1}{3}$.
The absolute maximum is $\frac{\sqrt{2}}{2}$ and it occurs at the left endpoint $x = 0$.
e. The absolute minimum is 0, and it occurs at the left endpoint $x = 0$.
The absolute maximum is $\frac{\sqrt{2}}{2}$, and it occurs at the right endpoint $x = \frac{1}{3}$.

____ 7. The formula for the power output of battery is $P = VI - RI^2$ where V is the electromotive force in volts, R is the resistance, and I is the current. Find the current (measured in amperes) that corresponds to a maximum value of P in a battery for which $V = 12$ volts and $R = 0.8$ ohm. Assume that a 10-ampere fuse bounds the output in the interval $0 \le I \le 10$. Round your answer to two decimal places.

a. 4.00 amperes
b. 4,050.00 amperes
c. 45.00 amperes
d. 40.00 amperes
e. 112.00 amperes

____ 8. Determine whether Rolle's Theorem can be applied to the function $f(x) = x^2 - 2x - 3$ on the closed interval [–1,3]. If Rolle's Theorem can be applied, find all values of c in the open interval (–1,3) such that $f'(c) = 0$.

a. Rolle's Theorem applies; $c = 1$
b. Rolle's Theorem applies; c = 2
c. Rolle's Theorem applies; $c = 0$
d. Rolle's Theorem applies; $c = -1$
e. Rolle's Theorem does not apply

____ 9. Determine whether Rolle's Theorem can be applied to $f(x) = \dfrac{x^2 - 13}{x}$ on the closed interval $\left[-13, 13\right]$. If Rolle's Theorem can be applied, find all values of c in the open interval $\left(-13, 13\right)$ such that $f'(c) = 0$.

a. $c = 8$
b. $c = 12$, $c = 11$
c. $c = 11$, $c = 8$
d. $c = 12$
e. Rolle's Theorem does not apply

____ 10. Determine whether the Mean Value Theorem can be applied to the function $f(x) = x^2$ on the closed interval [3,9]. If the Mean Value Theorem can be applied, find all numbers c in the open interval (3,9) such that $f'(c) = \dfrac{f(9) - f(3)}{9 - (3)}$.

a. MVT applies; $c = 6$
b. MVT applies; $c = 7$
c. MVT applies; $c = 4$
d. MVT applies; c = 5
e. MVT applies; $c = 8$

____ 11. Determine whether the Mean Value Theorem can be applied to the function $f(x) = x^3$ on the closed interval [0,16]. If the Mean Value Theorem can be applied, find all numbers c in the open interval (0,16) such that $f'(c) = \dfrac{f(16) - f(0)}{16 - 0}$.

a. MVT applies; $-\dfrac{16\sqrt{3}}{3}$
b. MVT applies; 4
c. MVT applies; $\dfrac{16\sqrt{3}}{3}$
d. MVT applies; 8
e. MVT does not apply

____ 12. The height of an object t seconds after it is dropped from a height of 550 meters is $s(t) = -4.9t^2 + 550$. Find the average velocity of the object during the first 7 seconds.

a. 34.30 m/sec
b. –34.30 m/sec
c. –49.00 m/sec
d. 49 m/sec
e. –16.00 m/sec

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____ 13. The height of an object t seconds after it is dropped from a height of 250 meters is $s(t) = -4.9t^2 + 250$. Find the time during the first 8 seconds of fall at which the instantaneous velocity equals the average velocity.

a. 32 seconds
b. 19.6 seconds
c. 6.38 seconds
d. 4 seconds
e. 2.45 seconds

____ 14. A company introduces a new product for which the number of units sold S is $S(t) = 300\left(5 - \dfrac{10}{3+t}\right)$ where t is the time in months since the product was introduced. During what month does $S'(t)$ equal the average value of $S(t)$ during the first year?

a. October
b. July
c. December
d. April
e. March

____ 15. A plane begins its takeoff at 2:00 P.M. on a 2200-mile flight. After 12.5 hours, the plane arrives at its destination. Explain why there are at least two times during the flight when the speed of the plane is 100 miles per hour.

a. By the Mean Value Theorem, there is a time when the speed of the plane must equal the average speed of 303 mi/hr. The speed was 100 mi/hr when the plane was accelerating to 303 mi/hr and decelerating from 303 mi/hr.

b. By the Mean Value Theorem, there is a time when the speed of the plane must equal the average speed of 152 mi/hr. The speed was 100 mi/hr when the plane was accelerating to 152 mi/hr and decelerating from 152 mi/hr.

c. By the Mean Value Theorem, there is a time when the speed of the plane must equal the average speed of 88 mi/hr. The speed was 100 mi/hr when the plane was accelerating to 88 mi/hr and decelerating from 88 mi/hr.

d. By the Mean Value Theorem, there is a time when the speed of the plane must equal the average speed of 117 mi/hr. The speed was 100 mi/hr when the plane was accelerating to 117 mi/hr and decelerating from 117 mi/hr.

e. By the Mean Value Theorem, there is a time when the speed of the plane must equal the average speed of 176 mi/hr. The speed was 100 mi/hr when the plane was accelerating to 176 mi/hr and decelerating from 176 mi/hr.

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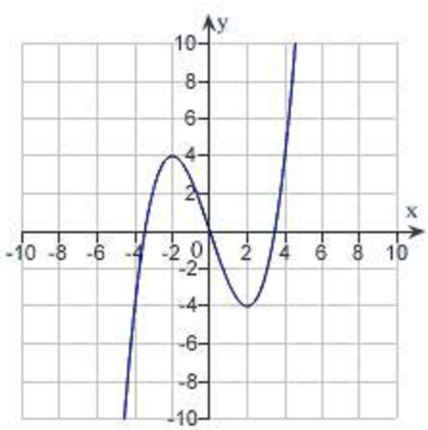
____ 16. Find a function f that has derivative $f'(x) = 12x - 6$ and with graph passing through the point (5,6).

a. $f(x) = \frac{6}{25}x^2$
b. $f(x) = 12x^2 - 6x - 112$
c. $f(x) = 6x^2 - 6x - 111$
d. $f(x) = 6x^2 - 6x - 114$
e. $f(x) = \frac{6}{5}x$

____ 17. Use the graph of the function $y = \frac{x^3}{4} - 3x$ given below to estimate the open intervals on which the function is increasing or decreasing.



a. increasing on $(-\infty,-2)$ and $(2,\infty)$; decreasing on $(2,2)$
b. increasing on $(-\infty,-2)$ and $(2,\infty)$; decreasing on $(-2,2)$
c. increasing on $(-2,2)$; decreasing on $(-\infty,-2)$ and $(2,\infty)$
d. increasing on $(-2,-2)$ and $(2,\infty)$; decreasing on $(-2,-2)$
e. increasing on $(-\infty,2)$ and $(2,\infty)$; decreasing on $(-2,\infty)$

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____ 18. Identify the open intervals where the function $f(x) = 6x^2 - 6x + 4$ is increasing or decreasing.

a. decreasing on $(-\infty, \infty)$
b. increasing on $(-\infty, \infty)$
c. increasing: $\left(-\infty, \frac{1}{2}\right)$; decreasing: $\left(\frac{1}{2}, \infty\right)$
d. decreasing on $(-\infty, 0)$; increasing on $(0, \infty)$
e. decreasing: $\left(-\infty, \frac{1}{2}\right)$; increasing: $\left(\frac{1}{2}, \infty\right)$

____ 19. Identify the open intervals where the function $f(x) = x\sqrt{30 - x^2}$ is increasing or decreasing.

a. decreasing: $\left(-\infty, \sqrt{15}\right)$; increasing: $\left(\sqrt{15}, \infty\right)$
b. decreasing on $(-\infty, \infty)$
c. increasing: $\left(-\infty, \sqrt{30}\right)$; decreasing: $\left(\sqrt{30}, \infty\right)$
d. increasing: $\left(-\sqrt{15}, \sqrt{15}\right)$; decreasing: $\left(-\sqrt{30}, -\sqrt{15}\right) \cup \left(\sqrt{15}, \sqrt{30}\right)$
e. increasing: $\left(-\sqrt{30}, \sqrt{15}\right) \cup \left(\sqrt{15}, \sqrt{30}\right)$; decreasing: $\left(-\sqrt{15}, \sqrt{15}\right)$

____ 20. Find the open interval(s) on which $f(x) = -2x^2 + 12x + 8$ is increasing or decreasing.

a. increasing on $(-\infty, 6)$; decreasing on $(6, \infty)$
b. increasing on $(-\infty, 16)$; decreasing on $(16, \infty)$
c. increasing on $(-\infty, 32)$; decreasing on $(32, \infty)$
d. increasing on $(-\infty, 24)$; decreasing on $(24, \infty)$
e. increasing on $(-\infty, 3)$; decreasing on $(3, \infty)$

____ 21. For the function $f(x) = (x-1)^{\frac{2}{3}}$:

(a) Find the critical numbers of f (if any);
(b) Find the open intervals where the function is increasing or decreasing; and
(c) Apply the First Derivative Test to identify all relative extrema.

Use a graphing utility to confirm your results.

a. (a) $x = 0$
(b) increasing: $(-\infty, 0)$; decreasing: $(0, \infty)$
(c) relative max: $f(0) = 1$

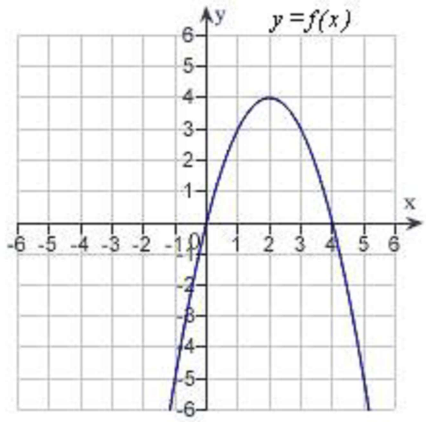
b. (a) $x = 1$
(b) increasing: $(-\infty, 1)$; decreasing: $(1, \infty)$
(c) relative max: $f(1) = 0$

c. (a) $x = 1$
(b) decreasing: $(-\infty, 1)$; increasing: $(1, \infty)$
(c) relative min: $f(1) = 0$

d. (a) $x = 0, 1$
(b) decreasing: $(-\infty, 0) \cup (1, \infty)$; increasing: $(0, 1)$
(c) relative min: $f(0) = 1$; relative max: $f(1) = 0$

e. (a) $x = 0$
(b) decreasing: $(-\infty, 0)$; increasing: $(0, \infty)$
(c) relative min: $f(0) = 1$

____ 22. The graph of *f* is shown in the figure. Sketch a graph of the derivative of *f*.



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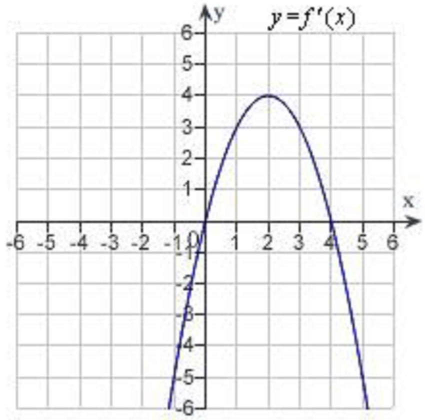
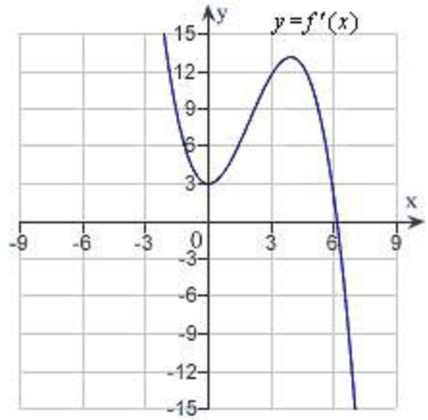
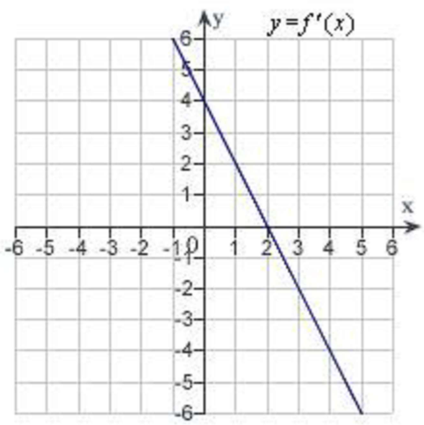
a.



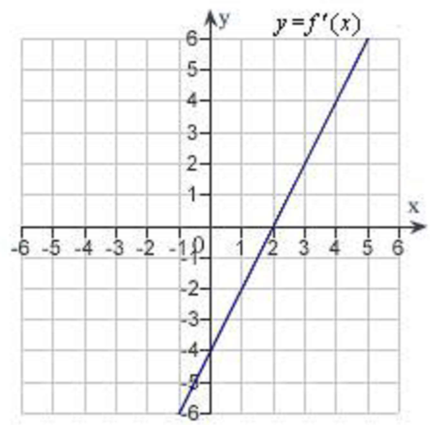
d.



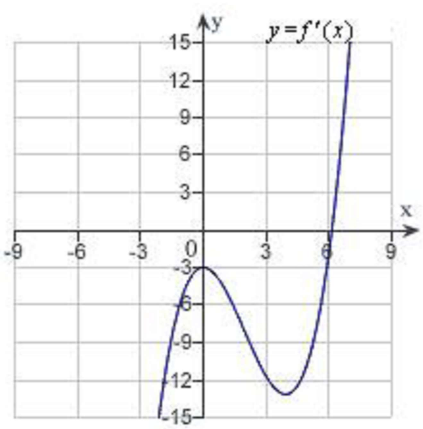
b.



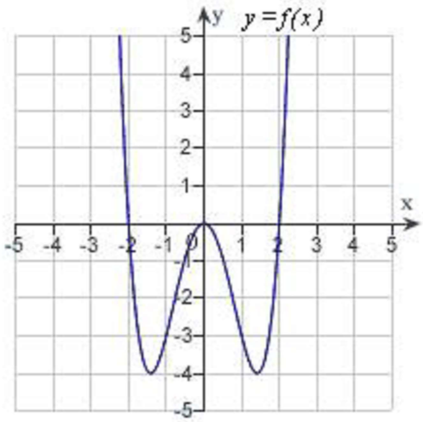
e.



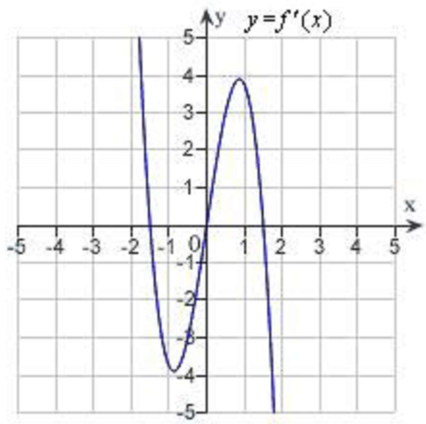
c.



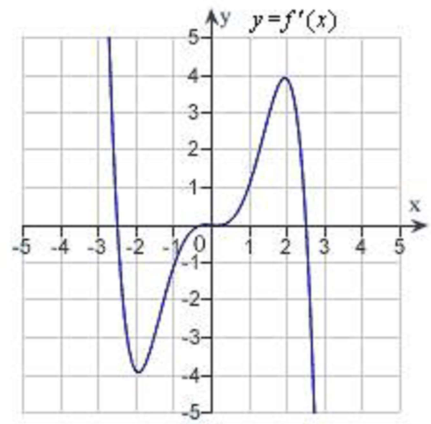
____ 23. The graph of f is shown in the figure. Sketch a graph of the derivative of f.



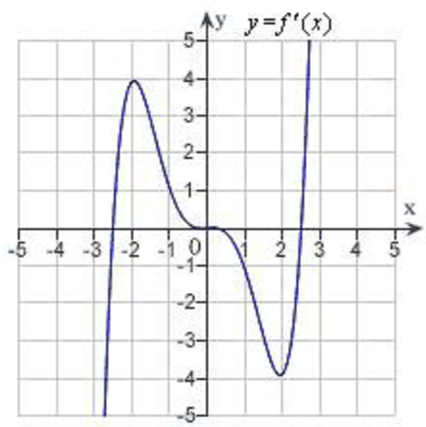
a.



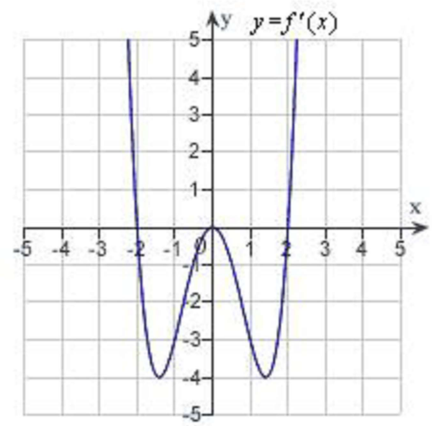
d.



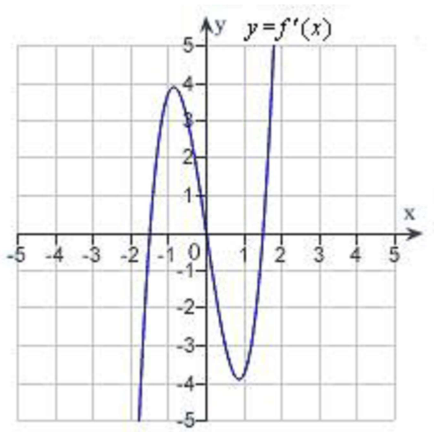
b.



e.



c.



____ 24. A ball bearing is placed on an inclined plane and begins to roll. The angle of elevation of the plane is θ radians. The distance (in meters) the ball bearing rolls in t seconds is $s(t) = 4.1(\sin\theta)t^2$. Determine the speed of the ball bearing after t seconds.

a. speed: $5.1(\sin\theta)t^2$ meters per second
b. speed: $(\sin\theta)t^2$ meters per second
c. speed: $8.2(\sin\theta)t$ meters per second
d. speed: $8.2(\cos\theta)t$ meters per second
e. speed: $4.1(\sin\theta)t^2$ meters per second

____ 25. A ball bearing is placed on an inclined plane and begins to roll. The angle of elevation of the plane is $\theta = \frac{\pi}{9}$ radians. The distance (in meters) the ball bearing rolls in t seconds is $s(t) = 4.9(\sin\theta)t^2$. Determine the value of $s'(t)$ after one second. Round numerical values in your answer to one decimal place.

a. $s'(t) = 3.4$
b. $s'(t) = 1.7$
c. $s'(t) = 4.5$
d. $s'(t) = 5.7$
e. $s'(t) = 2.4$

____ 26. Determine the open intervals on which the graph of $y = -6x^3 + 8x^2 + 6x - 5$ is concave downward or concave upward.

a. concave downward on $(-\infty, \infty)$
b. concave upward on $\left(-\infty, -\frac{4}{9}\right)$; concave downward on $\left(-\frac{4}{9}, \infty\right)$
c. concave upward on $\left(-\infty, \frac{4}{9}\right)$; concave downward on $\left(\frac{4}{9}, \infty\right)$
d. concave downward on $\left(-\infty, -\frac{4}{9}\right)$; concave upward on $\left(-\frac{4}{9}, \infty\right)$
e. concave downward on $\left(-\infty, \frac{4}{9}\right)$; concave upward on $\left(\frac{4}{9}, \infty\right)$

____ 27. Determine the open intervals on which the graph of $f(x) = 5x + 7\cos x$ is concave downward or concave upward.

a. concave downward on $\ldots,\left(-\frac{3\pi}{2},-\frac{\pi}{2}\right),\left(\frac{\pi}{2},\frac{3\pi}{2}\right),\left(\frac{5\pi}{2},\frac{7\pi}{2}\right),\ldots$; concave upward on $\ldots,\left(-\frac{5\pi}{2},-\frac{3\pi}{2}\right),\left(-\frac{\pi}{2},\frac{\pi}{2}\right),\left(\frac{3\pi}{2},\frac{5\pi}{2}\right),\ldots$

b. concave downward on $\ldots,\left(-\frac{3\pi}{4},-\frac{\pi}{4}\right),\left(\frac{\pi}{4},\frac{3\pi}{4}\right),\left(\frac{5\pi}{4},\frac{7\pi}{4}\right),\ldots$; concave upward on $\ldots,\left(-\frac{5\pi}{4},-\frac{3\pi}{4}\right),\left(-\frac{\pi}{4},\frac{\pi}{4}\right),\left(\frac{3\pi}{4},\frac{5\pi}{4}\right),\ldots$

c. concave upward on $\ldots,\left(-\frac{3\pi}{4},-\frac{\pi}{4}\right),\left(\frac{\pi}{4},\frac{3\pi}{4}\right),\left(\frac{5\pi}{4},\frac{7\pi}{4}\right),\ldots$; concave downward on $\ldots,\left(-\frac{5\pi}{4},-\frac{3\pi}{4}\right),\left(-\frac{\pi}{4},\frac{\pi}{4}\right),\left(\frac{3\pi}{4},\frac{5\pi}{4}\right),\ldots$

d. concave downward on $\ldots,\left(-\frac{3\pi}{6},-\frac{\pi}{6}\right),\left(\frac{\pi}{6},\frac{3\pi}{6}\right),\left(\frac{5\pi}{6},\frac{7\pi}{6}\right),\ldots$; concave upward on $\ldots,\left(-\frac{5\pi}{6},-\frac{3\pi}{6}\right),\left(-\frac{\pi}{6},\frac{\pi}{6}\right),\left(\frac{3\pi}{6},\frac{5\pi}{6}\right),\ldots$

e. concave upward on $\ldots,\left(-\frac{3\pi}{2},-\frac{\pi}{2}\right),\left(\frac{\pi}{2},\frac{3\pi}{2}\right),\left(\frac{5\pi}{2},\frac{7\pi}{2}\right),\ldots$; concave downward on $\ldots,\left(-\frac{5\pi}{2},-\frac{3\pi}{2}\right),\left(-\frac{\pi}{2},\frac{\pi}{2}\right),\left(\frac{3\pi}{2},\frac{5\pi}{2}\right),\ldots$

____ 28. Find the points of inflection and discuss the concavity of the function $f(x) = x\sqrt{x+16}$.

a. no inflection points; concave up on $(-16,\infty)$

b. no inflection points; concave down on $(-16,\infty)$

c. inflection point at $x = 16$; concave up on $(-16,\infty)$

d. inflection point at $x = 0$; concave up on $(-16,0)$; concave down on $(0,\infty)$

e. inflection point at $x = 16$; concave down on $(-16,\infty)$

____ 29. Find all relative extrema of the function $f(x) = -4x^2 - 32x - 62$. Use the Second Derivative Test where applicable.

a. relative max: $f(0) = -62$; no relative min
b. no relative max; no relative min
c. relative min: $f(-4) = 2$; relative max: $f(0) = -62$
d. relative min: $f(-4) = 2$; no relative max
e. relative min: $f(-4) = 2$; relative max: $f(0) = -62$

____ 30. Find all relative extrema of the function $f(x) = 2x^4 - 32x^3 + 4$. Use the Second Derivative Test where applicable.

a. relative max: $\left(24, 221188\right)$; no relative min
b. relative min: $\left(12, -13820\right)$; no relative max
c. relative min: $\left(24, 221188\right)$; no relative max
d. relative max: $\left(12, 13820\right)$; no relative min
e. no relative max or min

____ 31. Find all relative extrema of the function $f(x) = x^{2/3} - 6$. Use the Second Derivative Test where applicable.

a. relative minimum: $\left(0, -6\right)$
b. relative minimum: $\left(0, -5\right)$
c. relative maximum: $\left(0, -6\right)$
d. relative minimum: $\left(0, 2\right)$
e. relative maximum: $\left(0, 5\right)$

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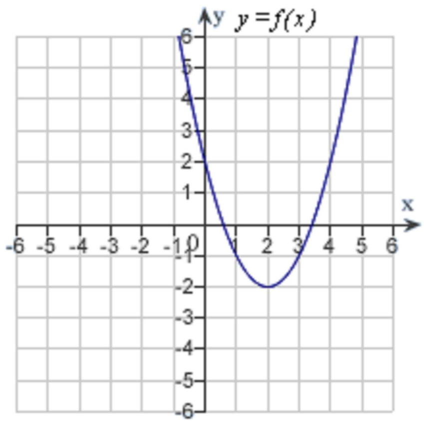
____ 32. The graph of f is shown. Graph f, f' and f'' on the same set of coordinate axes.



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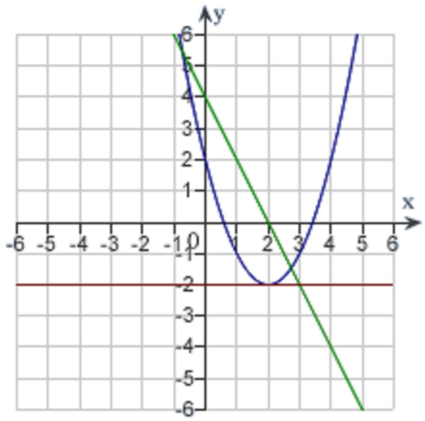
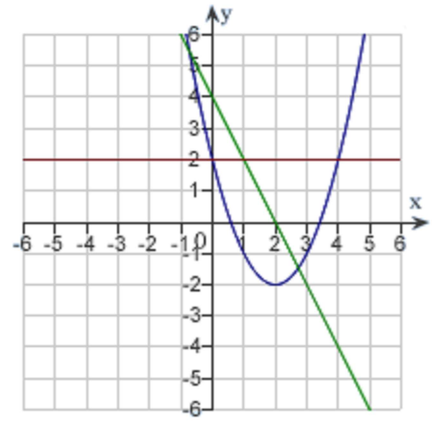
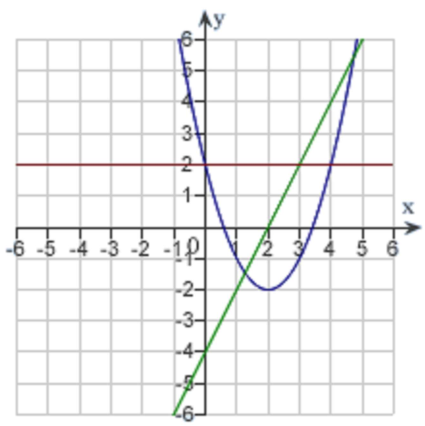
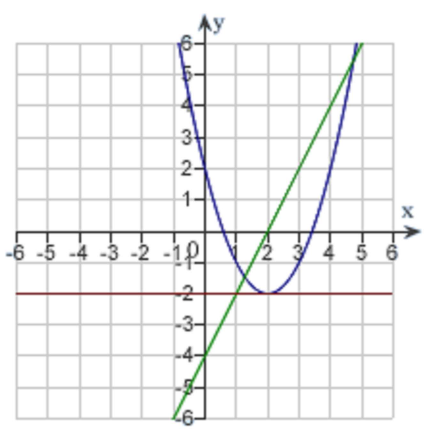
a. 

d. 

b. 

e. none of the above

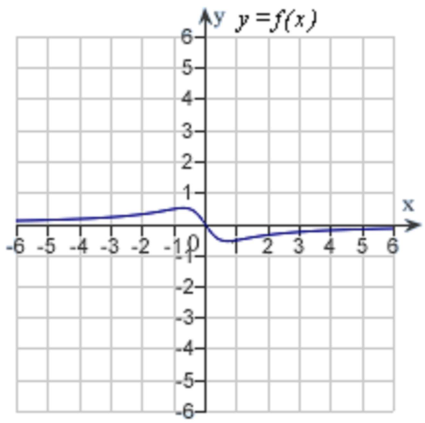
c. 

____ 33. Suppose a manufacturer has determined that the total cost C of operating a factory is $C = 0.6x^2 + 14x + 54,000$ where x is the number of units produced. At what level of production will the average cost per unit be minimized? (The average cost per unit is C/x.)

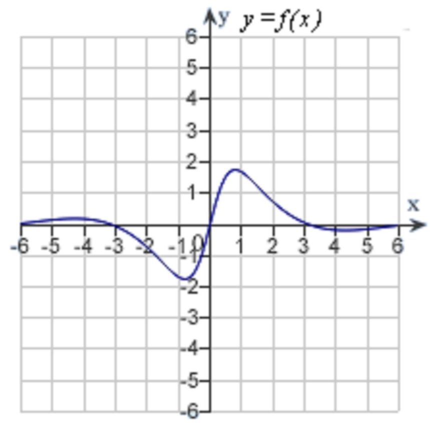
a. $x = 300$ units
b. $x = 330$ units
c. $x = 30$ units
d. $x = 60$ units
e. $x = 600$ units

____ 34. Match the function $f(x) = \dfrac{2x^2}{x^2 + 2}$ with one of the following graphs.

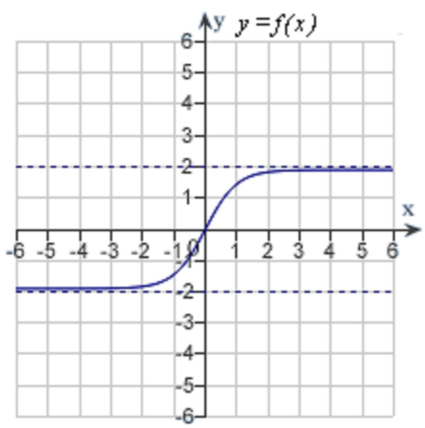
a.



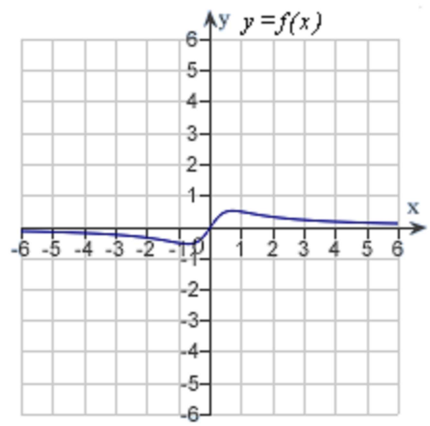
d.



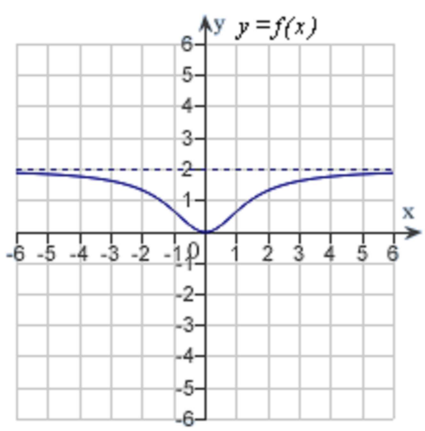
b.



e.



c.



____ 35. Find the limit.

$$\lim_{x \to \infty} \left(5 + \frac{3}{x^2} \right)$$

a. ∞

b. 3

c. $-\infty$

d. -3

e. 5

____ 36. Find the limit.

$$\lim_{x \to \infty} \frac{3x + 2}{-6x - 6}$$

a. 1

b. 0

c. $-\frac{1}{3}$

d. $-\frac{1}{2}$

e. does not exist

____ 37. Find the limit.

$$\lim_{x \to \infty} \frac{-8x + 2}{-5x^2 + 4}$$

a. $\frac{1}{2}$

b. 1

c. 0

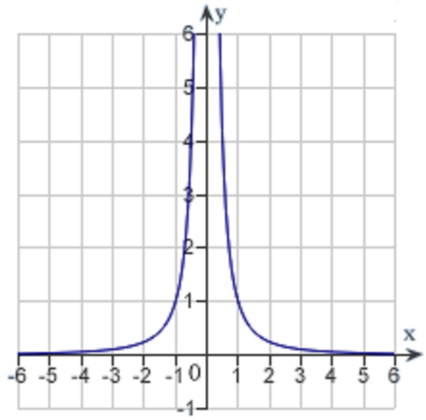
d. ∞

e. $\frac{8}{5}$

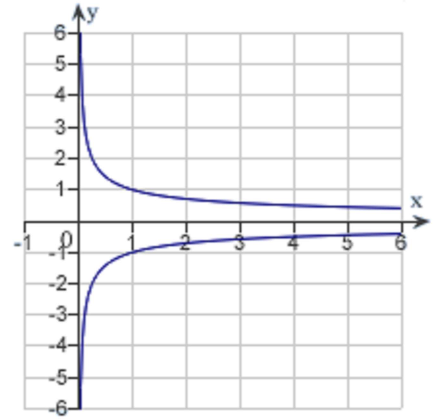
Name: ________________________ **ID: A**

____ 38. Sketch the graph of the function $f(x) = \dfrac{1+x}{1-x}$ using any extrema, intercepts, symmetry, and asymptotes.

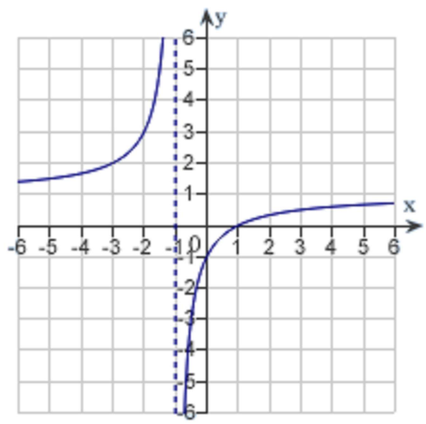
a.



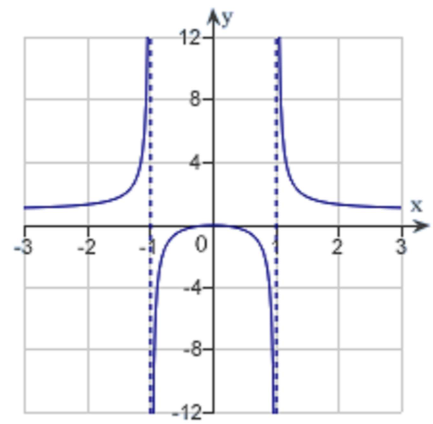
d.



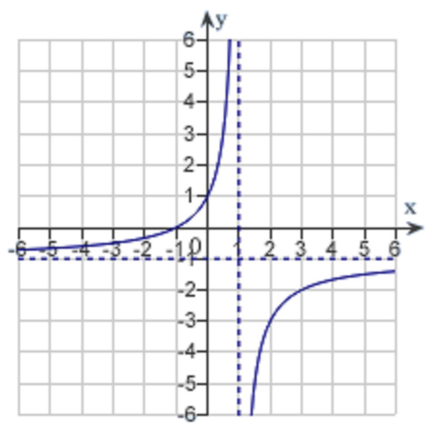
b.



e.



c.

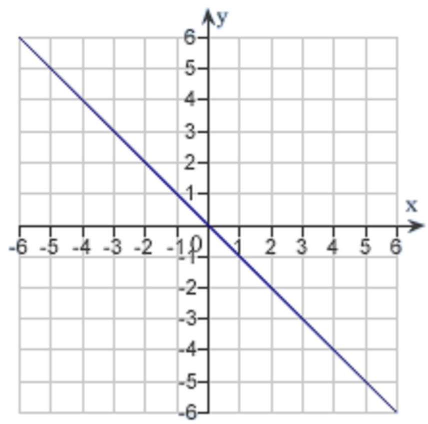


Name: ________________________ **ID: A**

____ 39. A heat probe is attached to the heat exchanger of a heating system. The temperature T (in degrees Celsius) is recorded t seconds after the furnace is started. A model for the data recorded for the first two minutes is given by $T = \dfrac{1351 + 78t}{54 + t}$. Find $\lim\limits_{t \to \infty} T$.

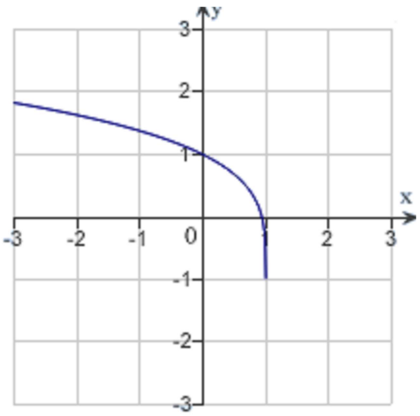
a. 1429°
b. 1351°
c. 54°
d. 78°
e. 25°

____ 40. The graph of a function f is is shown below.

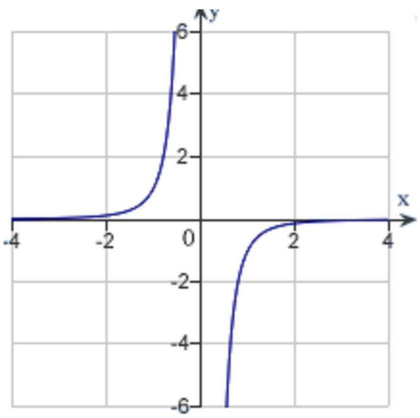


Sketch the graph of the derivative $f\,'$.

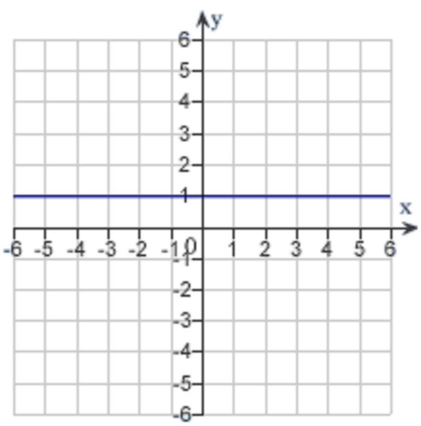
a.


y
x
3
2
1
0
-1
-2
-3
-3 -2 -1 1 2 3

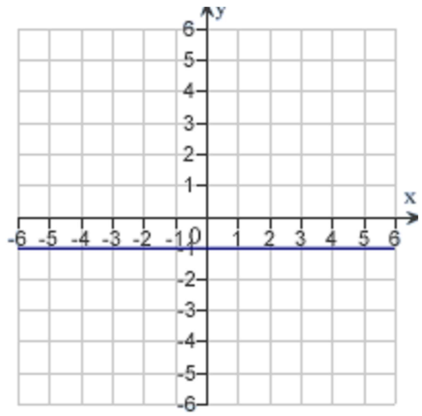
b.


y
x
6
4
2
0
-2
-4
-6
-4 -2 2 4

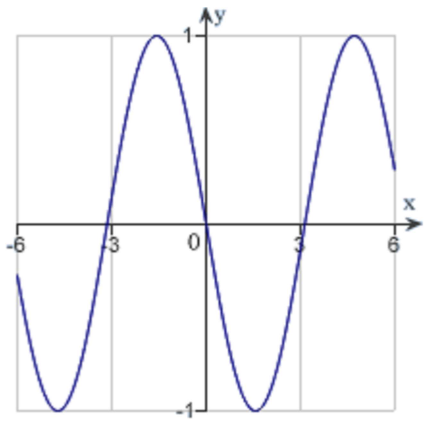
c.


y
x
6 5 4 3 2 1
-1 -2 -3 -4 -5 -6
-6 -5 -4 -3 -2 -1 0 1 2 3 4 5 6

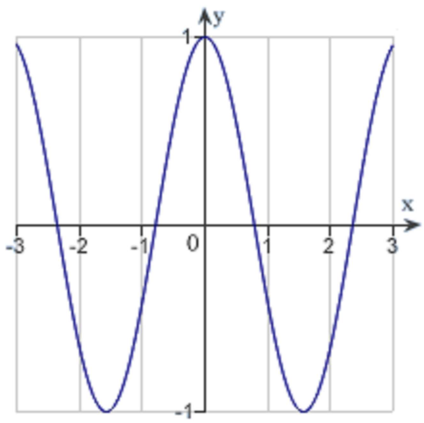
d.


y
x
6 5 4 3 2 1
-1 -2 -3 -4 -5 -6
-6 -5 -4 -3 -2 -1 0 1 2 3 4 5 6

e.

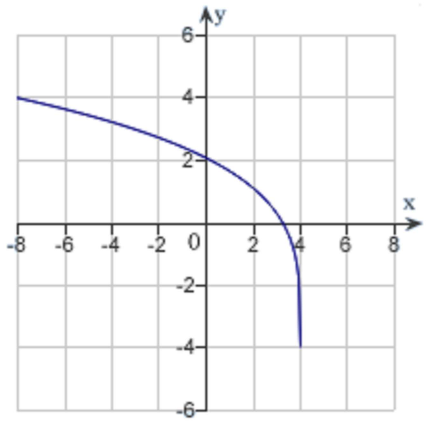

y
x
1
-1
-6 -3 0 3 6

____ 41. The graph of a function f is is shown below. Sketch the graph of the derivative $f\,'$.

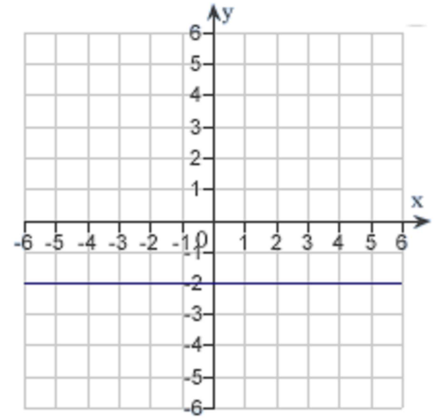


Name: ________________________ **ID: A**

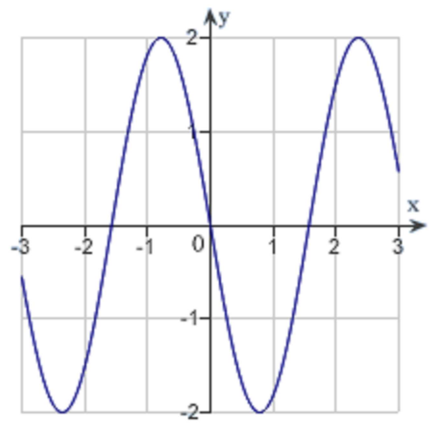
a.



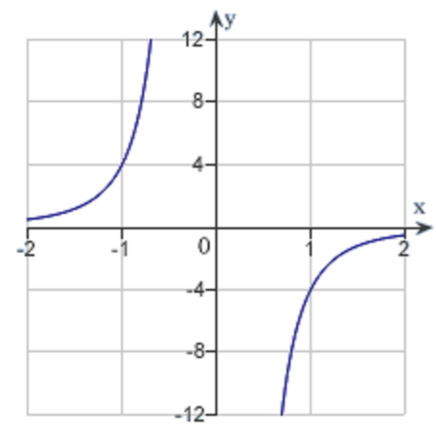
d.



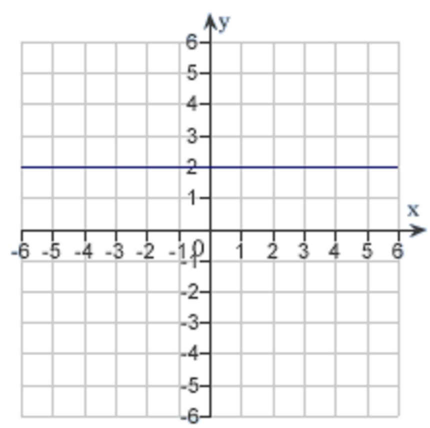
b.



e.



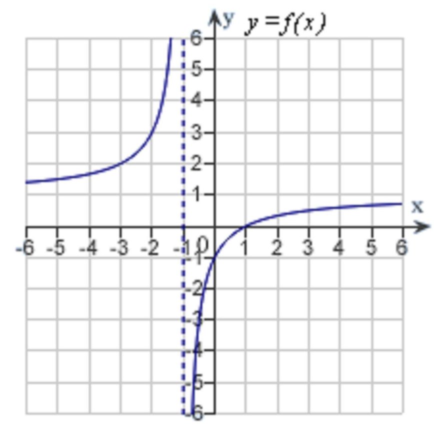
c.



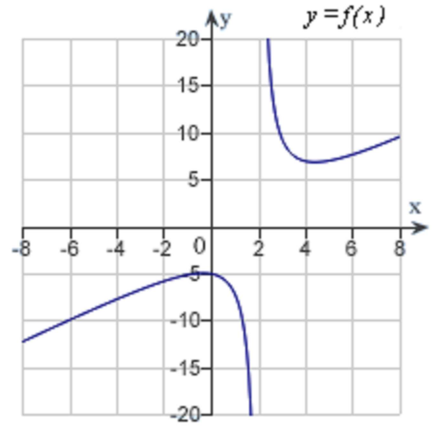
Name: ________________________ ID: A

____ 42. Analyze and sketch a graph of the function $f(x) = \dfrac{x}{1+x^4}$.

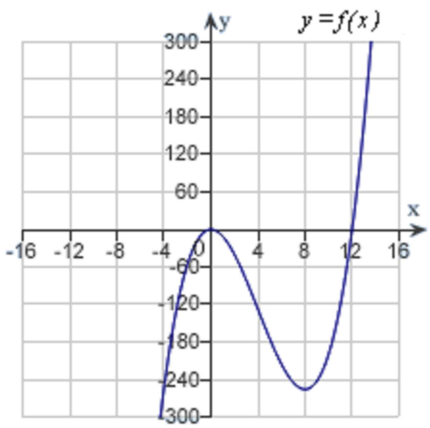
a.



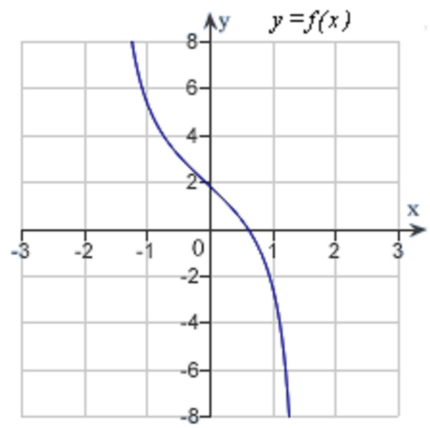
d.



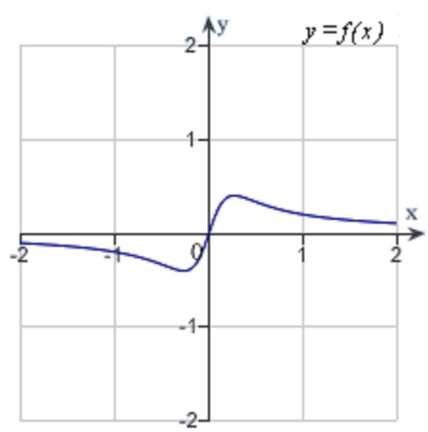
b.



e.



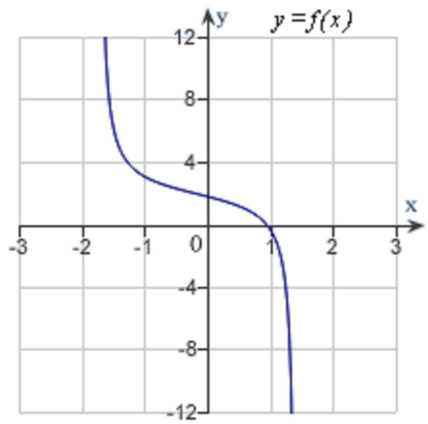
c.



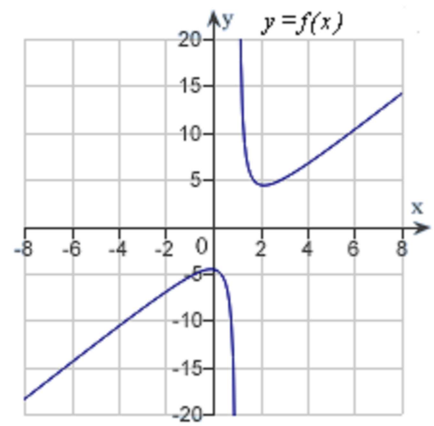
Name: ________________________ **ID: A**

____ 43. Analyze and sketch a graph of the function $f(x) = \dfrac{x}{x+1}$.

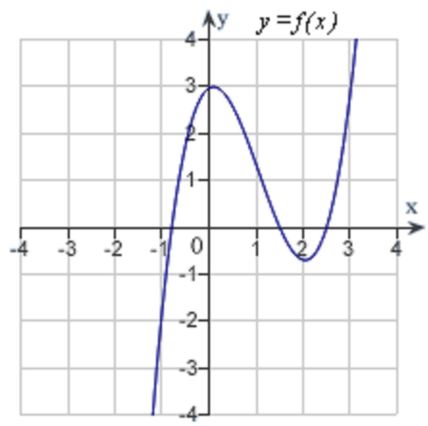
a.



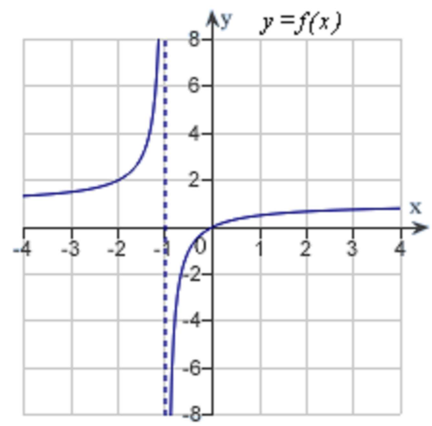
d.



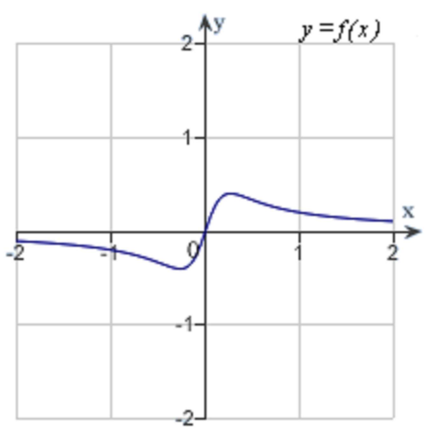
b.



e.

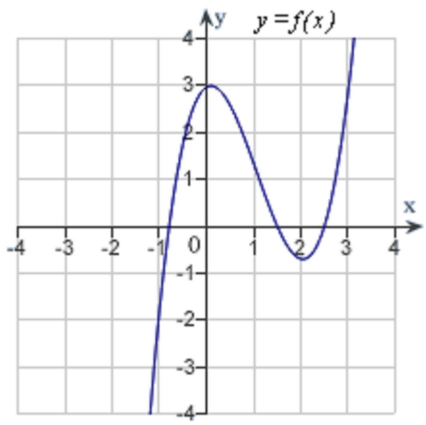


c.

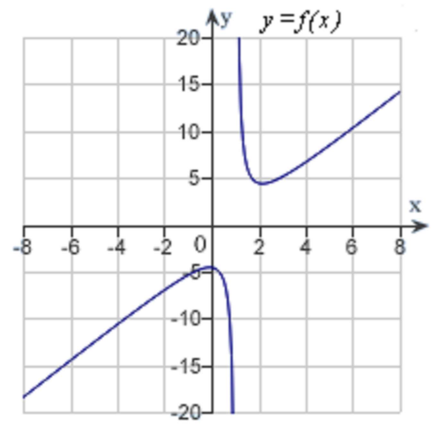


____ 44. Analyze and sketch a graph of the function $f(x) = \dfrac{x^2 - 2x + 9}{x}$.

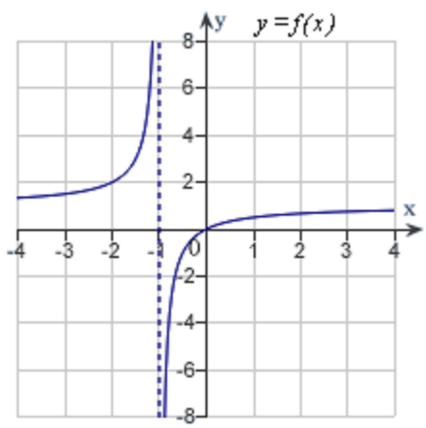
a.



d.

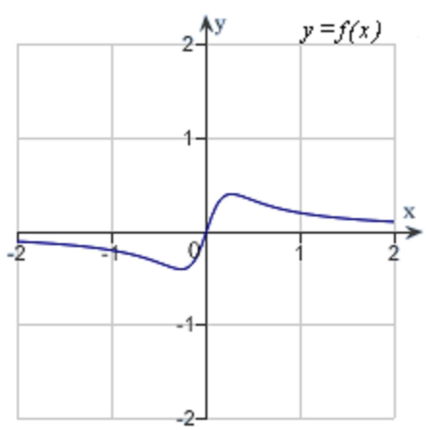


b.



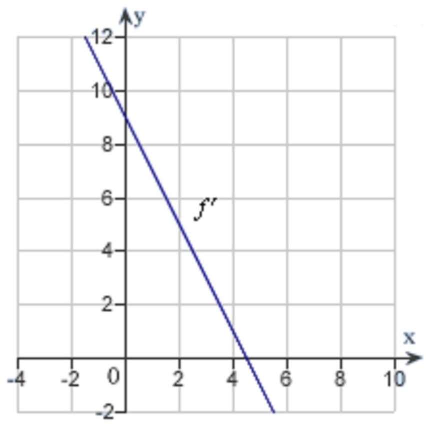
e. none of the above

c.

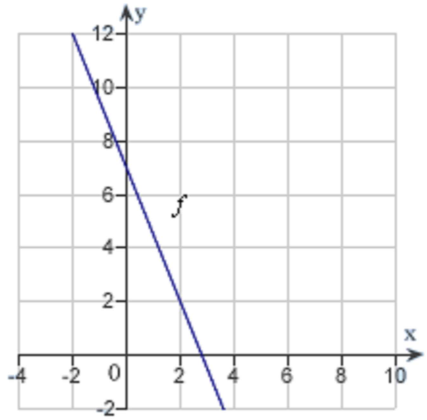


Name: ________________________ **ID: A**

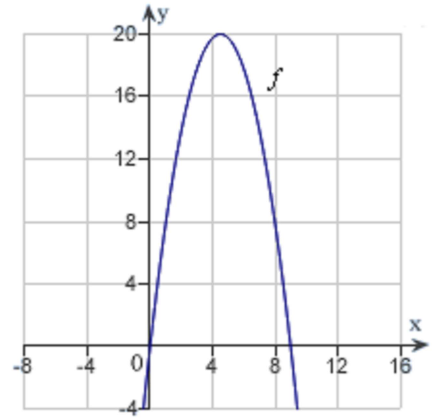
____ 45. Use the following graph of $f\,'$ to sketch a graph of f.



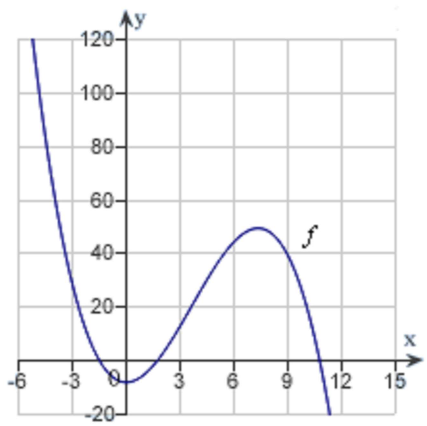
a.


y
x
f
12
10
8
6
4
2
-2
-4
-2
0
2
4
6
8
10

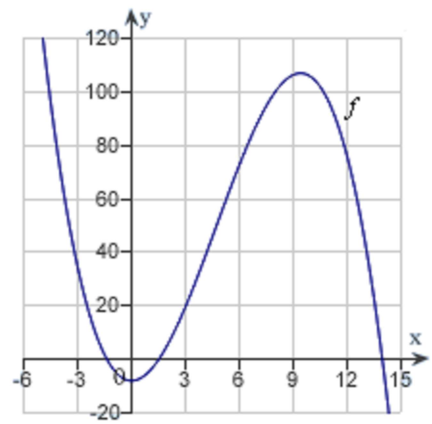
d.


y
x
f
20
16
12
8
4
-4
-8
-4
0
4
8
12
16

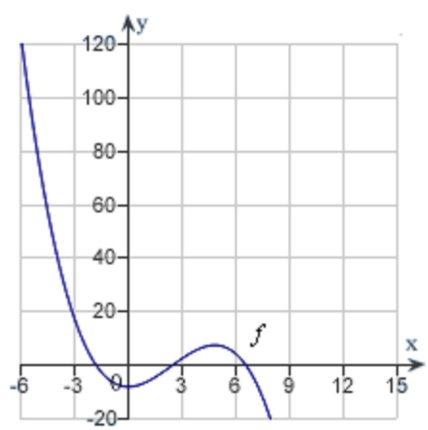
b.


y
x
f
120
100
80
60
40
20
-20
-6
-3
0
3
6
9
12
15

e.

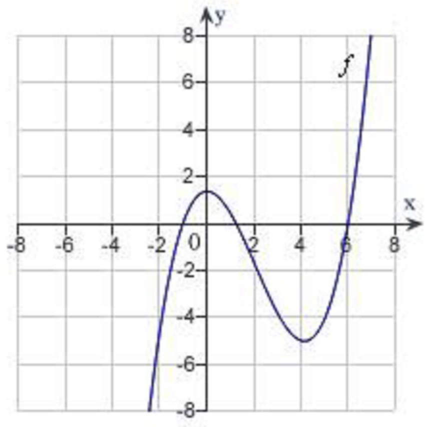

y
x
f
120
100
80
60
40
20
-20
-6
-3
0
3
6
9
12
15

c.


y
x
f
120
100
80
60
40
20
-20
-6
-3
0
3
6
9
12
15

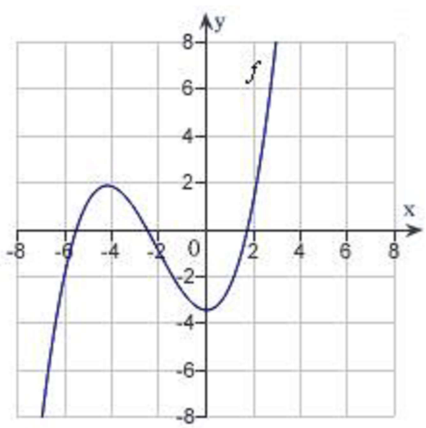
Name: ________________________ **ID: A**

____ 46. The graph of f is shown below. For which values of x is $f'(x)$ zero?



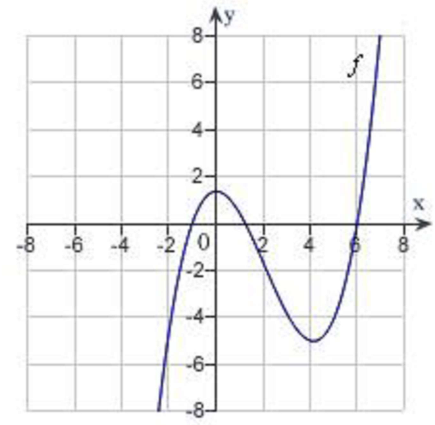
a. $x = 2; x = 0$
b. $x = 0; x = -1$
c. $x = 0; x = 6$
d. $x = 0; x = 4$
e. $x = -2; x = 1$

____ 47. The graph of f is shown below. For which value of x is $f''(x)$ zero?



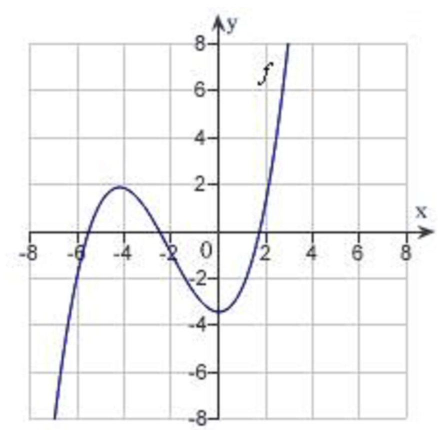
a. $x = 2$
b. $x = 0$
c. $x = -2$
d. $x = 6$
e. $x = 4$

____ 48. The graph of f is shown below. On what interval is $f\,'$ an increasing function?



a. $(0,\infty)$
b. $(-1,\infty)$
c. $(-2,\infty)$
d. $(1,\infty)$
e. $(2,\infty)$

____ 49. The graph of f is shown below. For which value of x is $f\,'(x)$ minimum?



a. $x = 4$
b. $x = 2$
c. $x = 0$
d. $x = -2$
e. $x = 6$

____ 50. Find the length and width of a rectangle that has perimeter 48 meters and a maximum area.

a. 12 m; 12 m.
b. 16 m; 9 m.
c. 1m; 23 m.
d. 13 m; 11 m.
e. 6 m; 18 m.

____ 51. Find the point on the graph of the function $f(x) = (x+1)^2$ that is closest to the point $(-5,1)$. Round all numerical values in your answer to four decimal places.

a. $(-2.3918, 1.9370)$
b. $(3.3811, 1.9370)$
c. $(2.3918, 1.9370)$
d. $(-1.937, 3.3811)$
e. $(-3.3811, 2.3918)$

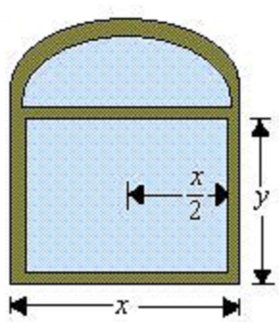
____ 52. Find the point on the graph of the function $f(x) = \sqrt{x}$ that is closest to the point $(18,0)$.

a. $\left(\frac{35}{2}, \sqrt{\frac{35}{2}}\right)$
b. $\left(\frac{37}{2}, \sqrt{\frac{37}{2}}\right)$
c. $\left(\frac{35}{2}, \sqrt{\frac{37}{2}}\right)$
d. $\left(\sqrt{\frac{37}{2}}, \frac{35}{2}\right)$
e. $\left(\sqrt{\frac{35}{2}}, \frac{35}{2}\right)$

____ 53. A rectangular page is to contain 144 square inches of print. The margins on each side are 1 inch. Find the dimensions of the page such that the least amount of paper is used.

a. $16, 16$
b. $13, 13$
c. $15, 15$
d. $25, 25$
e. $14, 14$

____ 54. A Norman window is constructed by adjoining a semicircle to the top of an ordinary rectangular window (see figure). Find the dimensions of a Norman window of maximum area if the total perimeter is 38 feet.



a. $x = \dfrac{76}{2+\pi}$ feet; $y = \dfrac{38}{2+\pi}$ feet

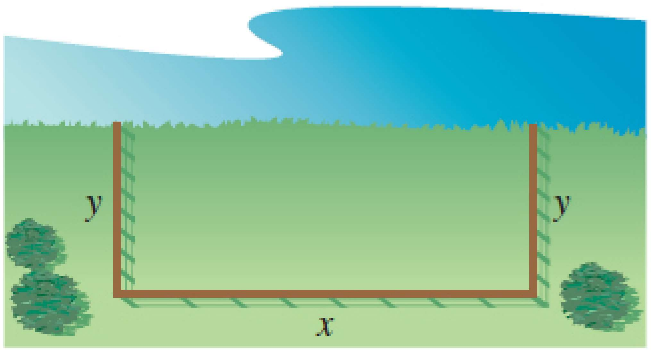
b. $x = \dfrac{114}{2+\pi}$ feet; $y = \dfrac{38}{2+\pi}$ feet

c. $x = \dfrac{38}{4+\pi}$ feet; $y = \dfrac{76}{4+\pi}$ feet

d. $x = \dfrac{76}{4+\pi}$ feet; $y = \dfrac{38}{4+\pi}$ feet

e. $x = \dfrac{38}{4+\pi}$ feet; $y = \dfrac{114}{4+\pi}$ feet

____ 55. A farmer plans to fence a rectangular pasture adjacent to a river (see figure). The pasture must contain 720,000 square meters in order to provide enough grass for the herd. No fencing is needed along the river. What dimensions will require the least amount of fencing?



a. $x = 600$ and $y = 1200$
b. $x = 1000$ and $y = 720$
c. $x = 1200$ and $y = 600$
d. $x = 720$ and $y = 1000$
e. none of the above

Ch 3 Practice
Answer Section

MULTIPLE CHOICE

1. ANS: D PTS: 1 DIF: Easy REF: Section 3.1
OBJ: Understand the relationship between the value of the derivative and the extremum of a function
MSC: Skill
2. ANS: A PTS: 1 DIF: Easy REF: Section 3.1
OBJ: Understand the relationship between the value of the derivative and the extremum of a function
MSC: Skill
3. ANS: B PTS: 1 DIF: Easy REF: Section 3.1
OBJ: Identify the critical numbers of a function MSC: Skill
4. ANS: C PTS: 1 DIF: Easy REF: Section 3.1
OBJ: Locate the absolute extrema of a function on a given closed interval
MSC: Skill
5. ANS: C PTS: 1 DIF: Medium REF: Section 3.1
OBJ: Locate the absolute extrema of a function on a given closed interval
MSC: Skill
6. ANS: A PTS: 1 DIF: Medium REF: Section 3.1
OBJ: Locate the absolute extrema of a function on a given closed interval
MSC: Skill
7. ANS: C PTS: 1 DIF: Medium REF: Section 3.1
OBJ: Locate the absolute extrema of a function in applications MSC: Application
8. ANS: A PTS: 1 DIF: Medium REF: Section 3.2
OBJ: Identify all values of c guaranteed by Rolle's Theorem MSC: Skill
9. ANS: E PTS: 1 DIF: Medium REF: Section 3.2
OBJ: Identify all values of c guaranteed by Rolle's Theorem MSC: Skill
10. ANS: A PTS: 1 DIF: Medium REF: Section 3.2
OBJ: Identify all values of c guaranteed by the Mean Value Theorem
MSC: Skill
11. ANS: C PTS: 1 DIF: Medium REF: Section 3.2
OBJ: Identify all values of c guaranteed by the Mean Value Theorem
MSC: Skill
12. ANS: B PTS: 1 DIF: Easy REF: Section 3.2
OBJ: Interpret the difference quotient in the MVT in applications
MSC: Application
13. ANS: D PTS: 1 DIF: Easy REF: Section 3.2
OBJ: Identify all values of c guaranteed by the Mean Value Theorem in applications
MSC: Application
14. ANS: D PTS: 1 DIF: Difficult REF: Section 3.2
OBJ: Identify all values of c guaranteed by the Mean Value Theorem in applications
MSC: Application
15. ANS: C PTS: 1 DIF: Medium REF: Section 3.2
OBJ: Identify all values of c guaranteed by the Mean Value Theorem in applications
MSC: Application

16. ANS: D PTS: 1 DIF: Medium REF: Section 3.2
OBJ: Construct a function that has a given derivative and passes through a given point
MSC: Skill
17. ANS: B PTS: 1 DIF: Easy REF: Section 3.3
OBJ: Estimate the intervals where a function is increasing and decreasing from a graph
MSC: Skill
18. ANS: E PTS: 1 DIF: Medium REF: Section 3.3
OBJ: Identify the intervals on which a function is increasing or decreasing
MSC: Skill
19. ANS: D PTS: 1 DIF: Medium REF: Section 3.3
OBJ: Identify the intervals on which a function is increasing or decreasing
MSC: Skill
20. ANS: E PTS: 1 DIF: Easy REF: Section 3.3
OBJ: Identify the intervals on which the function is increasing or decreasing
MSC: Skill
21. ANS: C PTS: 1 DIF: Medium REF: Section 3.3
OBJ: Identify the intervals on which the function is increasing or decreasing; Identify the relative extrema of a function by applying the First Derivative Test MSC: Skill
22. ANS: B PTS: 1 DIF: Medium REF: Section 3.3
OBJ: Graph a function's derivative given the graph of the function
MSC: Skill
23. ANS: C PTS: 1 DIF: Medium REF: Section 3.3
OBJ: Graph a function's derivative given the graph of the function
MSC: Skill
24. ANS: C PTS: 1 DIF: Easy REF: Section 3.3
OBJ: Interpret a derivative as a rate of change MSC: Application
25. ANS: A PTS: 1 DIF: Medium REF: Section 3.3
OBJ: Calculate derivatives in applications MSC: Application
26. ANS: C PTS: 1 DIF: Medium REF: Section 3.4
OBJ: Identify the intervals on which a function is concave up or concave down
MSC: Skill
27. ANS: E PTS: 1 DIF: Medium REF: Section 3.4
OBJ: Identify the intervals on which a function is concave up or concave down
MSC: Skill
28. ANS: A PTS: 1 DIF: Medium REF: Section 3.4
OBJ: Identify all points of inflection for a function and discuss the concavity
MSC: Skill
29. ANS: D PTS: 1 DIF: Medium REF: Section 3.4
OBJ: Identify all relative extrema for a function using the Second Derivative Test
MSC: Skill
30. ANS: B PTS: 1 DIF: Medium REF: Section 3.4
OBJ: Identify all relative extrema for a function using the Second Derivative Test
MSC: Skill
31. ANS: A PTS: 1 DIF: Medium REF: Section 3.4
OBJ: Identify all relative extrema for a function using the Second Derivative Test
MSC: Skill

32. ANS: D PTS: 1 DIF: Medium REF: Section 3.4
OBJ: Graph a function's derivative and second derivative given the graph of the function
MSC: Skill
33. ANS: A PTS: 1 DIF: Medium REF: Section 3.4
OBJ: Identify all relative extrema for a function in applications
MSC: Application
34. ANS: C PTS: 1 DIF: Medium REF: Section 3.5
OBJ: Identify the graph that matches the given function MSC: Skill
35. ANS: E PTS: 1 DIF: Medium REF: Section 3.5
OBJ: Evaluate the limit of a function at infinity MSC: Skill
36. ANS: D PTS: 1 DIF: Medium REF: Section 3.5
OBJ: Evaluate the limit of a function at infinity MSC: Skill
37. ANS: C PTS: 1 DIF: Medium REF: Section 3.5
OBJ: Evaluate the limit of a function at infinity MSC: Skill
38. ANS: C PTS: 1 DIF: Medium REF: Section 3.5
OBJ: Graph a function using extrema, intercepts, symmetry, and asymptotes
MSC: Skill
39. ANS: D PTS: 1 DIF: Medium REF: Section 3.5
OBJ: Evaluate limits at infinity in applications MSC: Application
40. ANS: D PTS: 1 DIF: Medium REF: Section 3.6
OBJ: Graph a function's derivative given the graph of the function
MSC: Skill
41. ANS: B PTS: 1 DIF: Medium REF: Section 3.6
OBJ: Graph a function's derivative given the graph of the function
MSC: Skill
42. ANS: C PTS: 1 DIF: Medium REF: Section 3.6
OBJ: Graph a function using extrema, intercepts, symmetry, and asymptotes
MSC: Skill
43. ANS: E PTS: 1 DIF: Medium REF: Section 3.6
OBJ: Graph a function using extrema, intercepts, symmetry, and asymptotes
MSC: Skill
44. ANS: E PTS: 1 DIF: Medium REF: Section 3.6
OBJ: Graph a function using extrema, intercepts, symmetry, and asymptotes
MSC: Skill
45. ANS: D PTS: 1 DIF: Medium REF: Section 3.6
OBJ: Graph a function given the graph of the function's derivative
MSC: Skill
46. ANS: D PTS: 1 DIF: Easy REF: Section 3.6
OBJ: Identify properties of the derivative of a function given the graph of the function
MSC: Skill
47. ANS: C PTS: 1 DIF: Easy REF: Section 3.6
OBJ: Identify properties of the second derivative of a function given the graph of the function
MSC: Skill
48. ANS: E PTS: 1 DIF: Easy REF: Section 3.6
OBJ: Identify properties of the derivative of a function given the graph of the function
MSC: Skill

49. ANS: D PTS: 1 DIF: Easy REF: Section 3.6
OBJ: Identify properties of the derivative of a function given the graph of the function
MSC: Skill
50. ANS: A PTS: 1 DIF: Medium REF: Section 3.7
OBJ: Apply calculus techniques to solve a minimum/maximum problem involving the area of a rectangle
MSC: Application
51. ANS: A PTS: 1 DIF: Difficult REF: Section 3.7
OBJ: Apply calculus techniques to solve a minimum/maximum problem involving the distance between points MSC: Application
52. ANS: A PTS: 1 DIF: Medium REF: Section 3.7
OBJ: Apply calculus techniques to solve a minimum/maximum problem involving the distance between points MSC: Application
53. ANS: E PTS: 1 DIF: Medium REF: Section 3.7
OBJ: Apply calculus techniques to solve a minimum/maximum problem involving the print area on a page
MSC: Application
54. ANS: D PTS: 1 DIF: Medium REF: Section 3.7
OBJ: Apply calculus techniques to solve a minimum/maximum problem involving the area of a Norman window MSC: Application
55. ANS: B PTS: 1 DIF: Easy REF: Section 3.7
OBJ: Apply calculus techniques to solve a minimum/maximum problem involving the area of a rectangle
MSC: Application