This print-out should have 33 questions. Multiple-choice questions may continue on the next column or page – find all choices before answering.

001 10.0 points

A tank holds 1000 gallons of water, which drains from the bottom of the tank in half an hour. The values in the table

t (min)	5	10	15	20	25	30
V (gal)	695	411	284	151	23	0

show the volume, $V(t)$, of water remaining in the tank (in gallons) after t minutes.

If P is the point $(15, V(15))$ on the graph of V as a function of time t, find the slope of the secant line PQ when $Q = (25, V(25))$.

1. slope $= -13.3$

2. slope $= -52.2$

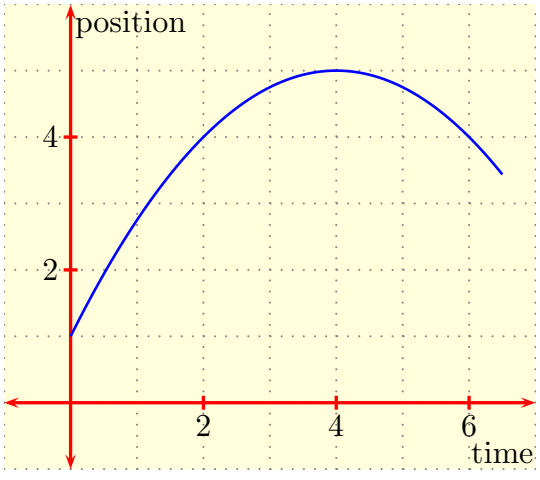
3. slope $= -12.7$

4. slope $= -41.1$

5. slope $= -26.1$

002 10.0 points

The position as a function of time t of a car initially heading due north on IH35 is shown in



List the values of

m_1 = average velocity on $[4, 5]$,

m_2 = instantaneous velocity at $t = 3$,

m_3 = instantaneous velocity at $t = 6$,

m_4 = average velocity on $[1, 3]$,

in increasing order.

1. $m_2 < m_1 < m_4 < m_3$

2. $m_3 < m_4 < m_2 < m_1$

3. $m_4 < m_1 < m_2 < m_3$

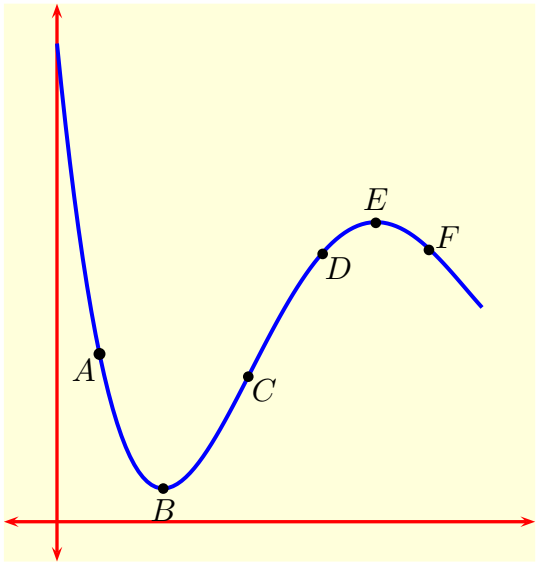
4. $m_3 < m_1 < m_2 < m_4$

5. $m_1 < m_2 < m_3 < m_4$

6. $m_2 < m_3 < m_1 < m_4$

003 (part 1 of 5) 10.0 points

At which point on the graph



is the slope greatest (*i.e.*, most positive)?

1. B

2. F

3. C

4. D

5. E

6. A

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004 (part 2 of 5) 10.0 points

At which point is the slope smallest (*i.e.*, most negative)?

1. C

2. E

3. B

4. F

5. D

6. A

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005 (part 3 of 5) 10.0 points

At which point does the slope change from positive to negative?

1. A

2. B

3. D

4. E

5. C

6. F

---

006 (part 4 of 5) 10.0 points

At which point does the slope change from negative to positive?

1. D

2. C

3. B

4. A

5. E

6. F

---

007 (part 5 of 5) 10.0 points

At which point is the tangent line parallel to the secant line $\overline{BF}$?

1. E

2. C

3. F

4. D

5. B

6. A

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008 10.0 points

When a ball is thrown vertically upward on the moon with a velocity of 30 ft/sec its height, $y(t)$, in feet after t seconds is given by

$$y(t) \;=\; 30t - 3t^2 \,.$$

Find the average velocity of the ball over the interval from 2 to $2 + h$ seconds, $h \neq 0$.

1. avg vel. $=\; (6h - 21)$ ft/sec

2. avg vel. $=\; (18 - 3h)$ ft/sec

3. avg vel. $=\; -(21 + 6h)$ ft/sec

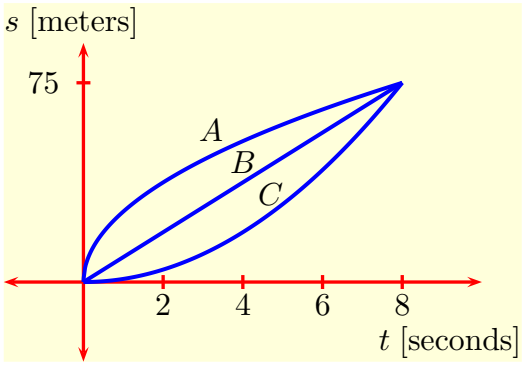
4. avg vel. $=\; (6h - 18)$ ft/sec

5. avg vel. $=\; (21 - 3h)$ ft/sec

6. avg vel. $=\; -(18 + 3h)$ ft/sec

009 10.0 points

Shown are the graphs of distance versus time for three runners A, B, and C who run a 75 -m race and finish in tie. Which of the following statements about the runners is **false**?



1. At $t = 1$, runner A has a higher velocity than B.

2. Runner A gradually slows down throughout the race.

3. At $t = 7$, runner B has a lower velocity than runner A.

4. Runner C gradually speeds up throughout the race.

5. Runner B runs as a constant speed throughout the race.

010 (part 1 of 3) 10.0 points

Determine the value of

$$\lim_{x \to 1+} \frac{x-2}{x-1}.$$

1. limit $= -2$

2. limit $= -\infty$

3. limit $= \infty$

4. none of the other answers

5. limit $= 2$

011 (part 2 of 3) 10.0 points

Determine the value of

$$\lim_{x \to 1-} \frac{x-2}{x-1}.$$

1. limit $= 2$

2. limit $= -2$

3. limit $= -\infty$

4. none of the other answers

5. limit $= \infty$

012 (part 3 of 3) 10.0 points

Determine the value of

$$\lim_{x \to 1} \frac{x-2}{x-1}.$$

1. limit $= -\infty$

2. limit $= 2$

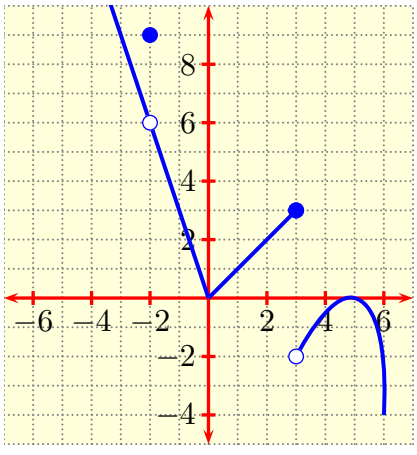
3. limit $= -2$

4. none of the other answers

5. limit $= \infty$

013 10.0 points

Below is the graph of a function f.



Use the graph to determine

$$\lim_{x \to 3} f(x) .$$

1. limit = 3

2. limit does not exist

3. limit = 9

4. limit = 6

5. limit = 18

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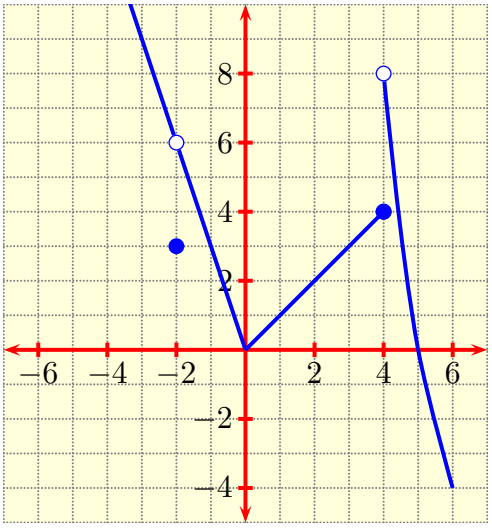
014 10.0 points

Below is the graph of a function f.



Use the graph to determine $\lim_{x \to -2} f(x)$.

1. $\lim_{x \to -2} f(x) = 3$

2. $\lim_{x \to -2} f(x) = 18$

3. $\lim_{x \to -2} f(x) = 4$

4. $\lim_{x \to -2} f(x) = 6$

5. $\lim_{x \to -2} f(x)$ does not exist

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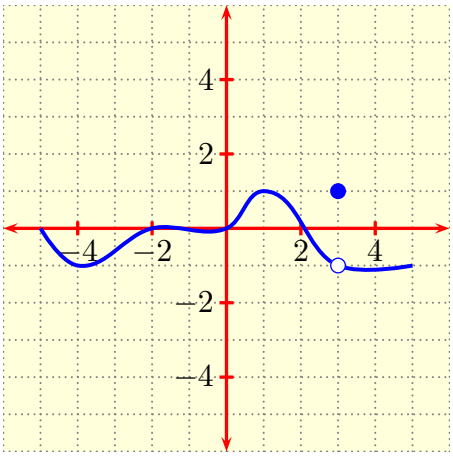
015 10.0 points

Below is the graph of a function f.



Use the graph to determine $\lim_{x \to 3} f(x)$.

1. limit = 2

2. does not exist

3. limit = −1

4. limit = 0

5. limit = 1

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016 10.0 points

When f is the function defined by

$$f(x) = \begin{cases} 3x - 2, & x \le 4 , \\ 4x - 7, & x > 4 , \end{cases}$$

determine if

$$\lim_{x \to 4^+} f(x)$$

exists, and if it does, find its value.

1. limit = 11

2. limit = 7

3. limit = 9

4. limit = 10

5. limit does not exist

6. limit = 8

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017 10.0 points

Consider the function

$$f(x) = \begin{cases} 1-x, & x < -1 \\ x, & -1 \le x < 2 \\ (x-3)^2, & x \ge 2\,. \end{cases}$$

Find all the values of a for which the limit

$$\lim_{x \to a} f(x)$$

exists, expressing your answer in interval notation.

1. $(-\infty, -1) \cup (-1, \infty)$

2. $(-\infty, -1) \cup (-1, 2) \cup (2, \infty)$

3. $(-\infty, -1] \cup [2, \infty)$

4. $(-\infty, 2) \cup (2, \infty)$

5. $(-\infty, \infty)$

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018 10.0 points

Evaluate

$$\lim_{x \to 1} (3x^2 + 4x + 1)\,.$$

1. limit $= 7$

2. limit $= 6$

3. limit doesn't exist

4. limit $= 8$

5. limit $= 10$

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019 10.0 points

Determine the limit

$$\lim_{x \to 1} \frac{2}{(x-1)^2}\,.$$

1. limit $= \infty$

2. none of the other answers

3. limit $= -2$

4. limit $= 2$

5. limit $= -\infty$

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020 10.0 points

Determine

$$\lim_{x \to 0} \frac{x-1}{x^2(x+8)}\,.$$

1. limit $= -\dfrac{1}{8}$

2. limit $= 1$

3. limit $= -\infty$

4. limit $= \infty$

5. none of the other answers

6. limit $= 0$

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021 10.0 points

Let F be the function defined by

$$F(x) = \frac{x^2 - 4}{|x-2|}\,.$$

Determine if the limit

$$\lim_{x \to 2^+} F(x)$$

exists, and if it does, find its value.

1. limit $= -4$

2. limit does not exist

3. limit $= 4$

4. limit $= 2$

5. limit $= -2$

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022 10.0 points

Let F be the function defined by

$$F(x) = \frac{x^2 - 4}{|x - 2|}.$$

Determine if

$$\lim_{x \to 2^-} F(x)$$

exists, and if it does, find its value.

1. limit $= 4$

2. limit does not exist

3. limit $= -4$

4. limit $= -2$

5. limit $= 2$

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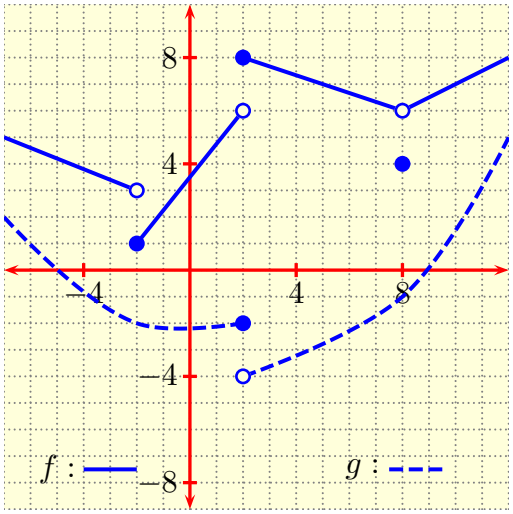
023 10.0 points

Below are the graphs of functions f and g.



Use these graphs to determine

$$\lim_{x \to 2} \left(f(x) + g(x)\right).$$

1. limit $= 1$

2. limit does not exist

3. limit $= 5$

4. limit $= 4$

5. limit $= 8$

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024 10.0 points

Determine

$$\lim_{x \to 3} \left\{ \frac{3}{x^2 - 3x} - \frac{1}{x - 3} \right\}.$$

1. limit $= \frac{1}{3}$

2. limit $= \frac{1}{2}$

3. limit $= 3$

4. limit does not exist

5. limit $= -3$

6. limit $= -\frac{1}{2}$

7. limit $= -\frac{1}{3}$

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025 10.0 points

Determine

$$\lim_{x \to 0} \left(\frac{2}{x^2 + 2x} - \frac{1}{x} \right).$$

1. limit $= \frac{1}{3}$

2. limit $= -\frac{1}{2}$

3. limit $= \frac{1}{2}$

4. limit $= -\frac{1}{3}$

5. limit $= -2$

6. limit $= 2$

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026 10.0 points

Evaluate

$$\lim_{x \to -4} \frac{x+4}{x^2 - x - 20}\,.$$

1. limit does not exist

2. limit $= -\dfrac{2}{9}$

3. limit $= -\dfrac{1}{9}$

4. limit $= \dfrac{1}{9}$

5. limit $= \dfrac{2}{9}$

6. limit $= -1$

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027 10.0 points

Find the value of

$$\lim_{x \to 0} \frac{(x+3)^2 - 9}{6x}$$

if the limit exists.

1. limit $= -\dfrac{1}{2}$

2. limit $= 1$

3. limit does not exist

4. limit $= -1$

5. limit $= \dfrac{1}{2}$

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028 10.0 points

Find the value of

$$\lim_{x \to 5} \frac{3x - 15}{\sqrt{x} - \sqrt{5}}$$

if the limit exists.

1. limit $= 8\sqrt{5}$

2. limit does not exist

3. limit $= 6\sqrt{5}$

4. limit $= 3\sqrt{5}$

5. limit $= 4\sqrt{5}$

6. limit $= 30$

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029 10.0 points

Find the value of $b,\ b \geq 0$, for which

$$\lim_{x \to 0} \left\{ \frac{\sqrt{x+b} - 1}{x} \right\}$$

exists.

1. $b = 1$

2. $b = 4$

3. $b = 0$

4. $b = 3$

5. $b = 2$

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030 10.0 points

Find the value of

$$\lim_{x \to 3} \frac{\sqrt{x+1} - 2}{3(x-3)}$$

if the limit exists.

1. limit $= \dfrac{1}{6}$

2. limit $= \dfrac{2}{5}$

3. limit $= \dfrac{1}{12}$

4. limit does not exist

5. limit $= \dfrac{1}{3}$

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031 10.0 points

Find the value of

$$\lim_{x \to 4} \frac{4}{x-4}\left(1 + \frac{2}{x-6}\right)$$

if the limit exists.

1. limit $= 2$

2. limit $= \dfrac{5}{2}$

3. limit $= -2$

4. limit $= -\dfrac{5}{2}$

5. limit does not exist

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032 10.0 points

Determine if the limit

$$\lim_{x \to 0} \frac{\dfrac{9}{x+1} - 9}{x}$$

exists, and if it does, find its value.

1. limit does not exist

2. limit $= -9$

3. limit $= 10$

4. limit $= 9$

5. limit $= -10$

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033 10.0 points

Find the value of

$$\lim_{x \to 0} \frac{x}{\sqrt{16 + 5x} - 4}\,.$$

1. limit $= \dfrac{5}{8}$

2. limit $= \dfrac{8}{5}$

3. limit $= 0$

4. limit $= \infty$

5. limit $= \dfrac{5}{4}$

6. limit $= \dfrac{4}{5}$