This print-out should have 39 questions. Multiple-choice questions may continue on the next column or page – find all choices before answering.

001 10.0 points

Determine

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

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

2. limit $= -2$

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

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

5. limit $= -\dfrac{1}{2}$ **correct**

6. limit $= 2$

Explanation:

After simplification we see that

$$\frac{2}{x^2 + 2x} - \frac{1}{x} = \frac{2 - (x+2)}{x(x+2)} = -\frac{1}{x+2},$$

for all $x \neq 0$. Thus

$$\boxed{\text{limit} = \lim_{x \to 0} -\frac{1}{x+2} = -\frac{1}{2}}.$$

002 10.0 points

Determine if the limit

$$\lim_{x \to 0} \frac{\dfrac{6}{x+1} - 6}{x}$$

exists, and if it does, find its value.

1. limit $= -6$ **correct**

2. limit does not exist

3. limit $= 6$

4. limit $= 7$

5. limit $= -7$

Explanation:

After bringing the numerator to a common denominator and rearranging, we obtain,

$$\frac{\dfrac{6}{x+1} - 6}{x} = \frac{6 - 6(x+1)}{x(x+1)}$$

$$= -\frac{6x}{x(x+1)} = -\frac{6}{x+1}.$$

Now

$$\lim_{x \to 0} \left(\frac{6}{x+1} \right)$$

exists, so the limit

$$\lim_{x \to 0} \frac{\dfrac{6}{x+1} - 6}{x}$$

exists and

$$\boxed{\text{limit} = -\lim_{x \to 0} \left(\frac{6}{x+1} \right) = -6}.$$

003 10.0 points

Determine which, if any, of

$$f(x) = 6^{-x} + 3,$$

$$g(x) = 6^{3-x},$$

$$h(x) = -6^{x-3},$$

define the same function.

1. only f, h

2. only g, h

3. $f, g,$ and h

4. only g, f

5. no two of f, g, or h **correct**

Explanation:
By the Laws of Exponents,

$$f(x) = 6^{-x} + 3,$$

while

$$g(x) = 6^{3-x} = 6^3 \cdot 6^{-x},$$

and

$$h(x) = -6^{x-3} = -\left(6^x \cdot 6^{-3}\right).$$

Consequently,

$$\boxed{\text{no two of } f,\ g,\ \text{or } h}$$

define the same function.

---

004 10.0 points

Determine which, if any, of the following

$$f(x) = 9^x + 9,$$

$$g(x) = 3^{2x+3},$$

$$h(x) = 27\,(9^x),$$

define the same function.

1. f, g, and h

2. only f, h

3. only g, h **correct**

4. only g, f

5. none of f, g, or h

Explanation:
By the Laws of Exponents,

$$f(x) = 9^x + 9 = (3^2)^x + 9$$
$$= 3^{2x} + 9,$$

while $g(x) = 3^{2x+3}$ and

$$h(x) = 27\,(9^x) = (3^3)(3^2)^x$$
$$= (3^3)(3^{2x}) = 3^{2x+3}.$$

Thus g and h define the same function. On the other hand,

$$f(0) = 10, \qquad g(0) = 27 = h(0),$$

so neither g nor h can define the same function as f. Consequently

$$\boxed{\text{only } g,\ h}$$

define the same function.

---

005 (part 1 of 2) 10.0 points
Write the polynomial

$$6 - 5x + 5x^4 - 7x^9$$

in standard form.
a) What is its degree?

Correct answer: 9.

Explanation:
Standard form is

$$-7x^9 + 5x^4 - 5x + 6$$

The highest power of x is 9.

---

006 (part 2 of 2) 10.0 points
b) What is the leading coefficient?

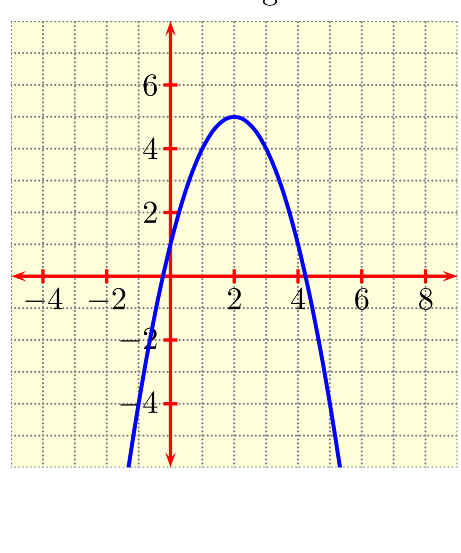
Correct answer: -7.

Explanation:
The coefficient of the highest power of x is -7.

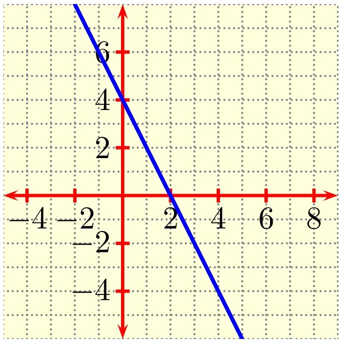
---

007 10.0 points

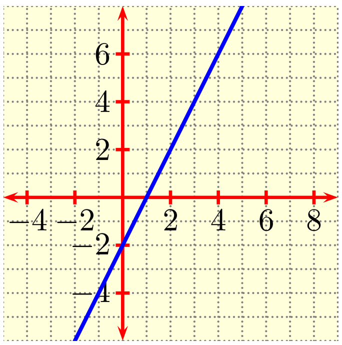
If f is a function having

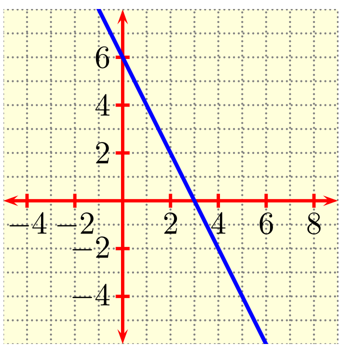


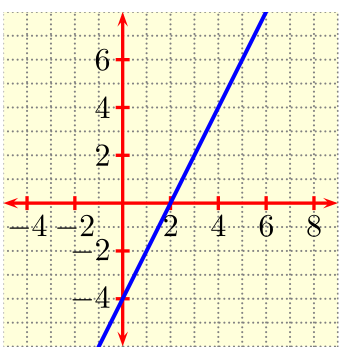
as its graph, which of the following could be the graph of f'?

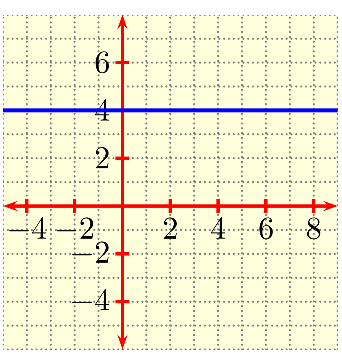
1. 

correct

2. 

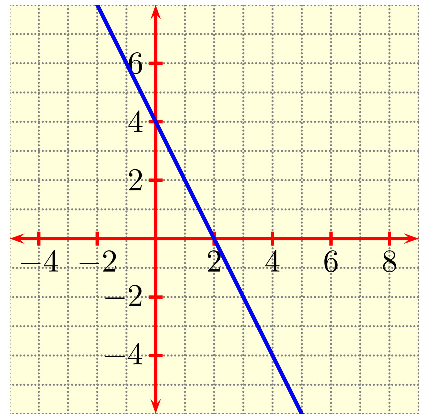
3. 

4. 

5. 

Explanation:

The slope of the tangent to the graph is zero at $x = 2$, is positive to the left of $x = 2$ and is negative to the right of $x = 2$. In addition, the slope of the tangent is decreasing as x increases, so the graph of f' is



---

008 10.0 points

Determine

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

1. limit $= 1$

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

3. limit $= -\infty$ **correct**

4. limit $= \infty$

5. limit $= 0$

6. none of the other answers

Explanation:

Now

$$\lim_{x \to 0} x - 1 = -1\,.$$

On the other hand, $x^2(x + 8) > 0$ for all small x, both positive and negative, while

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

Consequently,

$$\boxed{\text{limit} = -\infty}\,.$$

keywords: evaluate limit, rational function

009 10.0 points

If a, b are the solutions of the exponential equation

$$3^{x^2} = 9^{-\frac{3}{2}x+9}$$

calculate the value of $|a+b|$.

1. $|a+b| = -3$

2. $|a+b| = 3$ **correct**

3. $|a+b| = 5$

4. $|a+b| = 11$

5. $|a+b| = 4$

Explanation:

By properties of exponents,

$$9^{-\frac{3}{2}x+9} = 3^{-3x+18}.$$

Thus the equation can be rewritten as

$$3^{x^2} = 3^{-3x+18},$$

which after taking logs to the base 3 becomes

$$x^2 = -3x + 18.$$

This equation factors as

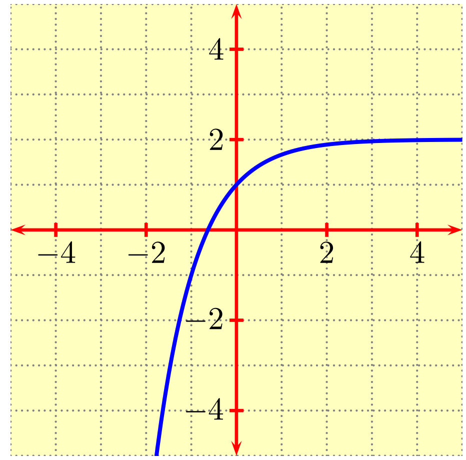
$$(x-3)(x+6) = 0,$$

and so its solutions are 3, -6. Hence

$$\boxed{|a+b| = 3.}$$

010 10.0 points

Which function has



as its graph?

1. $f(x) = 3^x - 3$

2. $f(x) = 3^{-x} - 2$

3. $f(x) = 2 - 3^{-x}$ **correct**

4. $f(x) = 2^{-x-1} - 2$

5. $f(x) = 2^{x-1} - 3$

6. $f(x) = 2 - 2^{-x-1}$

Explanation:

The given graph has the property that

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

But

$$\lim_{x\to\infty} 2^{-x} = 0 = \lim_{x\to\infty} 3^{-x},$$

while

$$\lim_{x\to-\infty} 2^{x} = 0 = \lim_{x\to-\infty} 3^{x},$$

so $f(x)$ must be one of

$$2 - 3^{-x}, \qquad 2 - 2^{-x-1}.$$

On the other hand, the y-intercept of the given graph is at $y = 1$.

Consequently, the graph is that of

$$\boxed{f(x) = 2 - 3^{-x}}.$$

011 10.0 points

The straight line ℓ is parallel to $y + 4x = 5$ and passes through the point $P(4,\, 3)$. Find its y-intercept.

1. y-intercept $=$ 20

2. y-intercept $=$ 21

3. y-intercept $=$ 19 **correct**

4. y-intercept $=$ -13

5. y-intercept $=$ -12

Explanation:

Since ℓ is parallel to the line $y + 4x = 5$, these lines have the same slope -4, Thus by the point-slope formula the equation of ℓ is given by

$$y - 3 \;=\; -4(x - 4).$$

Now the y-intercept of ℓ occurs at $x = 0$. Consequently,

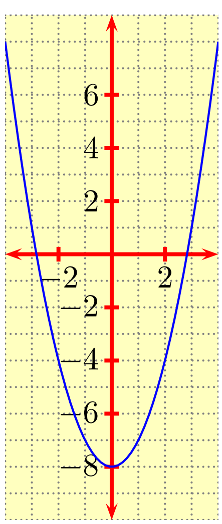
$$\boxed{y\text{-intercept} \;=\; 19.}$$

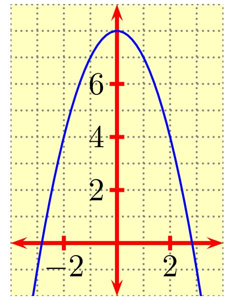
---

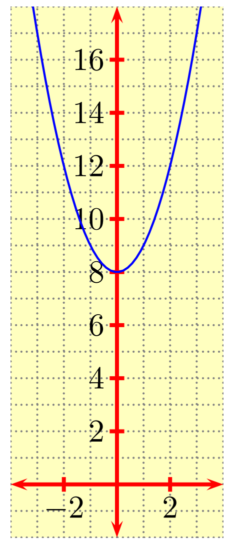
012 10.0 points

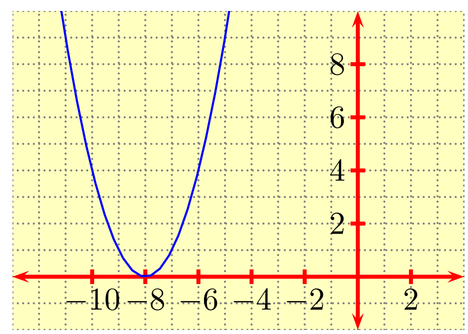
Sketch the graph of the function

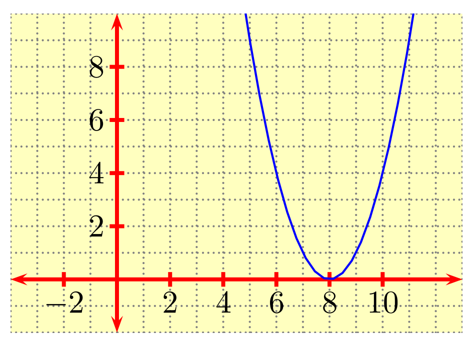
$$f(x) = (x+8)^2\,.$$

1. 

2. 

3. 

4.  **correct**

5. 

6. None of these

Explanation:

The graph of the function

$$f(x) = (x+8)^2 = [x - (-8)]^2$$

can be obtained from the graph of the function

$g(x) = x^2$ by shifting it 8 units to the left.

---

013 10.0 points

Find all values of x at which the function f defined by

$$f(x) = \frac{x-8}{x^2+9}$$

is not continuous?

1. $x = 3$

2. $x = -3,\ 8$

3. $x = -3,\ 3$

4. $x = 8$

5. $x = -3$

6. no values of x **correct**

Explanation:

Because f is a rational function it will fail to be continuous only at zeros of the denominator. Since there are no real solutions to

$$x^2 = -9,$$

the function is continuous everywhere; put another way, f fails to be continuous at

$$\boxed{\text{no values of } x}.$$

---

014 10.0 points

Determine which of the following functions (if any) are the same.

$$f(x) = 9^{-x} + 7$$

$$g(x) = 9^{7-x}$$

$$h(x) = -9^{x-7}$$

1. $f(x) = g(x) = h(x)$

2. None of these **correct**

3. $g(x) = f(x)$ only

4. $g(x) = h(x)$ only

5. $f(x) = h(x)$ only

Explanation:

$$f(x) = 9^{-x} + 7$$

$$g(x) = 9^{7-x} = 9^7 \cdot 9^{-x}$$

$$h(x) = -9^{x-7} = -\left(9^x \cdot 9^{-7}\right)$$

Thus $f(x)$, $g(x)$ and $h(x)$ are all distinct.

---

015 10.0 points

Find all values of x at which the function f defined by

$$f(x) = \frac{x-7}{x^2-x-42}$$

is continuous, expressing your answer in interval notation.

1. $(-\infty, -6) \cup (-6, \infty)$

2. $(-\infty, -7) \cup (-7, 6) \cup (6, \infty)$

3. $(-\infty, 7) \cup (7, \infty)$

4. $(-\infty, -6) \cup (-6, 7) \cup (7, \infty)$ **correct**

5. $(-\infty, -6) \cup (-6, -7) \cup (-7, \infty)$

Explanation:

After factorization the denominator becomes

$$x^2 - x - 42 = (x-7)(x+6),$$

so f can be rewritten as

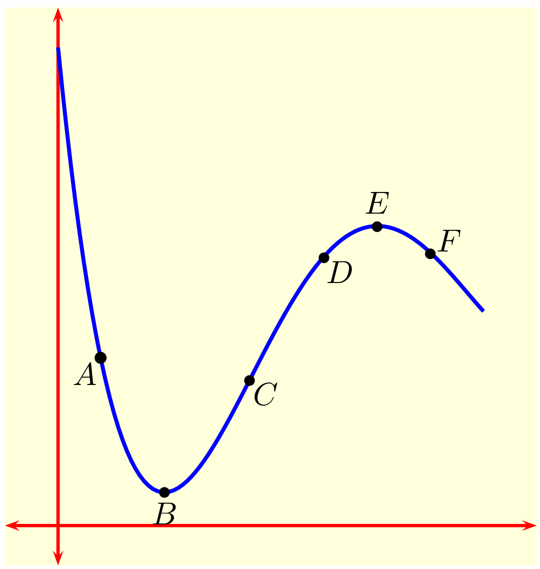
$$f(x) = \frac{x-7}{(x-7)(x+6)} = \frac{1}{(x+6)}$$

whenever $x \neq 7$. At $x = 7$ both the numerator and denominator will be zero; thus f will not be defined, hence not continuous, at $x = 7$. Elsewhere f is a ratio of polynomial functions and so will be continuous except at zeros of its denominator. Thus f will continuous except at $x = 7, -6$. Consequently, in interval notation f will be continuous on

$$\boxed{(-\infty, -6) \cup (-6, 7) \cup (7, \infty)}\,.$$

016 (part 1 of 5) 10.0 points

At which point on the graph



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

1. B
2. A
3. C **correct**
4. E
5. F
6. D

Explanation:
By inspection the point is C.

017 (part 2 of 5) 10.0 points

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

1. D
2. E
3. C
4. F
5. B
6. A **correct**

Explanation:
By inspection the point is A.

018 (part 3 of 5) 10.0 points

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

1. E **correct**
2. C
3. F
4. A
5. D
6. B

Explanation:
By inspection the point is E.

019 (part 4 of 5) 10.0 points

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

1. E
2. B **correct**
3. D
4. F
5. A
6. C

Explanation:
By inspection the point is B.

---

020 (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. B

4. F

5. A

6. D **correct**

Explanation:
By inspection the point is D.

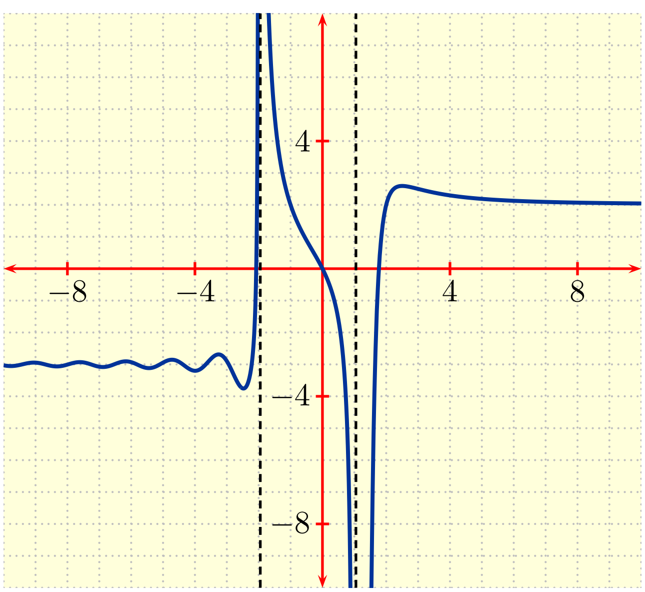
---

keywords: slope, graph, change of slope

---

021 (part 1 of 3) 10.0 points

A certain function f is given by the graph



(i) What is the value of

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

1. limit does not exist

2. limit $= 2$

3. limit $= -2$

4. limit $= 3$

5. limit $= -3$ **correct**

Explanation:
To the left of $x = -2$ the graph of f oscillates about the line $y = -3$ and as x approaches $-\infty$ the oscillations become smaller and smaller. Thus

$$\boxed{\text{limit} = -3}.$$

---

022 (part 2 of 3) 10.0 points

(ii) What is the value of

$$\lim_{x \to \infty} f(x)?$$

1. limit $= 2$ **correct**

2. limit does not exist

3. limit $= -3$

4. limit $= 3$

5. limit $= -2$

Explanation:
To the right of $x = 1$ the graph of f is asymptotic to the line $y = 2$. Thus

$$\boxed{\text{limit} = 2}.$$

---

023 (part 3 of 3) 10.0 points

(iii) What is the value of

$$\lim_{x \to -2} f(x)?$$

1. limit $= -2$

2. limit $= \infty$ **correct**

3. limit $=$ 2

4. limit $=$ 3

5. limit $=$ -3

Explanation:

From the graph of f the left hand limit

$$\lim_{x \to -2-} f(x) = \infty,$$

while the right hand limit

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

Thus the two-sided limit

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

---

024 10.0 points

Find the largest value of c so that the function g defined by

$$g(x) = \begin{cases} x^2 - 3x - c^2, & x > 3, \\ cx - 4, & x \le 3, \end{cases}$$

is continuous for all x.

1. $c = 4$

2. $c = 5$

3. $c = -5$

4. none of these **correct**

5. $c = -4$

Explanation:

Since g is linear for $x \le 3$ and quadratic for $x > 3$, g is continuous for all $x \ne 3$. On the other hand,

$$\lim_{x \to 3+} g(x) = -c^2$$

while

$$\lim_{x \to 3-} g(x) = 3c - 4 = g(3).$$

Thus g is continuous at $x = 3$ when

$$-c^2 = 3c - 4, \quad i.e., \quad c^2 + 3c - 4 = 0.$$

But

$$c^2 + 3c - 4 = 0 = (c+4)(c-1),$$

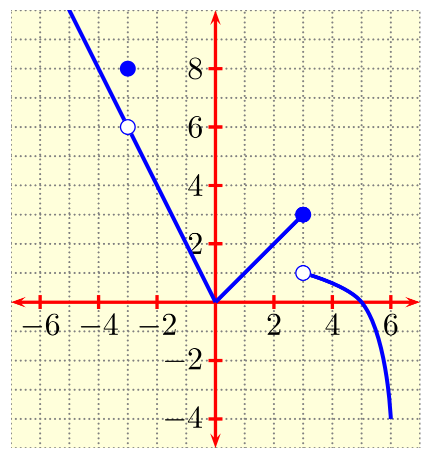
so g is continuous for all x when

$$\boxed{c = -4, 1}.$$

---

025 10.0 points

Below is the graph of a function f.



Use the graph to determine

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

1. limit $=$ 8

2. limit $=$ 12

3. limit $=$ 6

4. limit does not exist **correct**

5. limit $=$ 3

Explanation:

From the graph it is clear the f has a left hand limit at $x = 3$ which is equal to 3; and a right hand limit which is equal to 1. Since the two numbers do not coincide, the

$$\boxed{\text{limit does not exist}}\,.$$

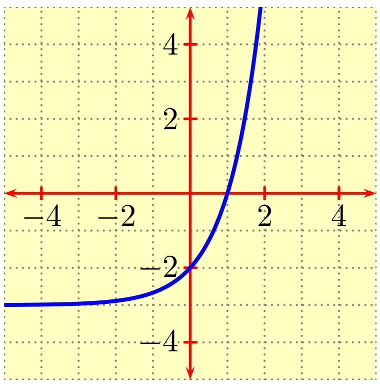
---

026 10.0 points

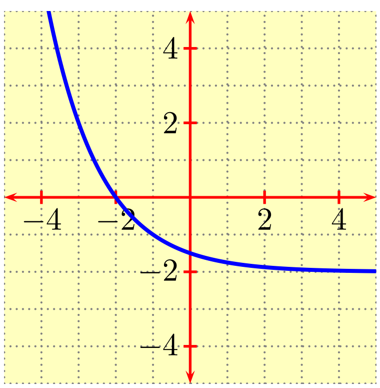
Which of the following is the graph of

$$f(x) \;=\; 2^{x-1} - 3\,?$$

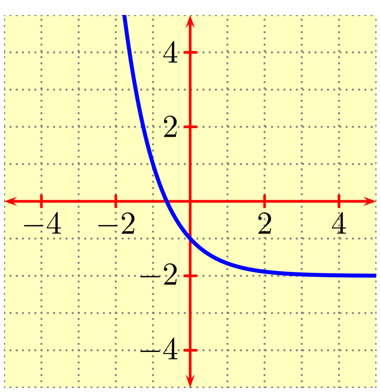
1.



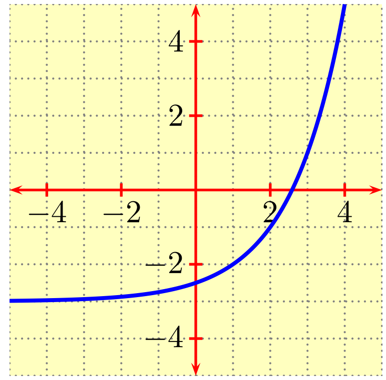
2.



3.

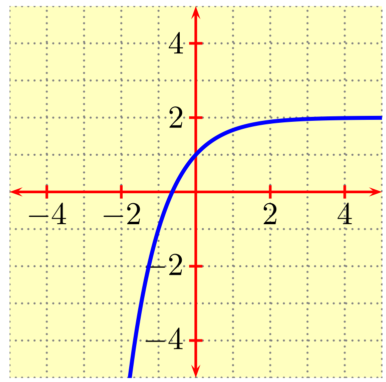


4.

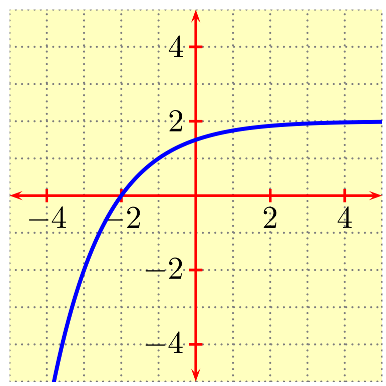


correct

5.



6.



Explanation:

Since

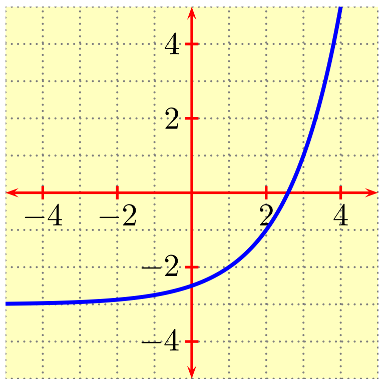
$$\lim_{x\to-\infty} 2^x \;=\; 0\,,$$

we see that

$$\lim_{x\to-\infty} f(x) \;=\; -3\,,$$

in particular, f has a horizontal asymptote $y = -3$. This eliminates all but two of the graphs. On the other hand, $f(0) = -\dfrac{5}{2}$, so the y-intercept of the given graph must occur at $y = -\dfrac{5}{2}$.

Consequently, the graph is of f is



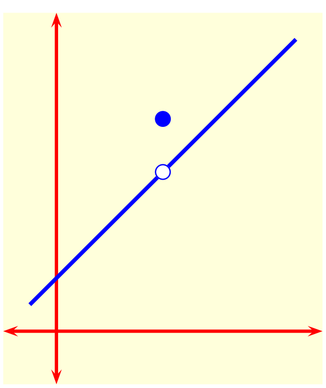
---

027 10.0 points

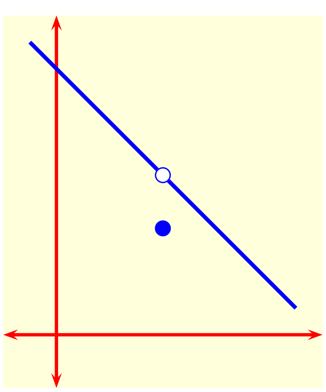
Determine which of the following could be the graph of f near the origin when

$$f(x) = \begin{cases} \dfrac{x^2 - 7x + 10}{2 - x}, & x \neq 2, \\[2ex] 2\,, & x = 2. \end{cases}$$

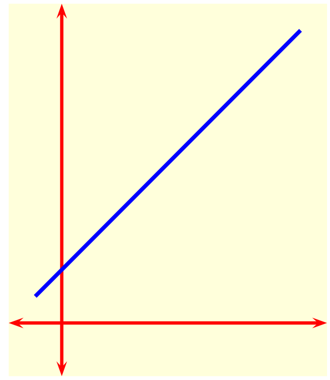
1.



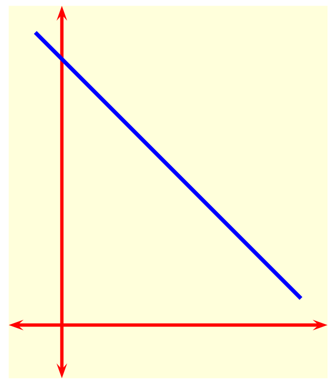
2. **correct**



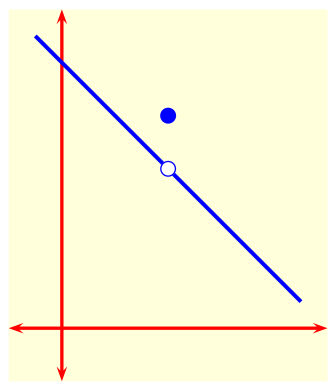
3.



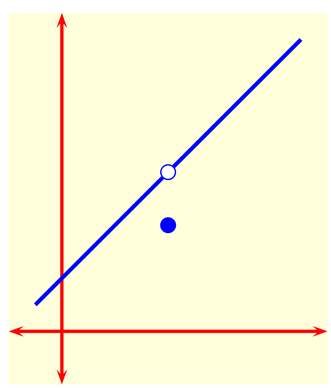
4.



5.



6.



Explanation:

Since

$$\frac{x^2 - 7x + 10}{2 - x} = \frac{(x-2)(x+5)}{2-x} = 5 - x\,,$$

for $x \neq 2$, we see that f is linear on

$$(-\infty,\, 2) \bigcup (2,\, \infty)\,,$$

while

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

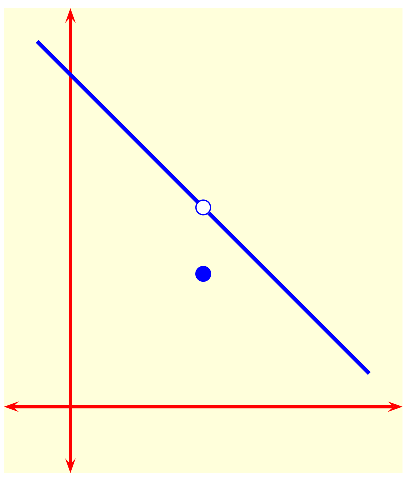
Thus the graph of f will be a straight line of slope -1, having a hole at $x = 2$. This eliminates four of the possible graphs. But the two remaining graphs are the same except that in one

$$f(2) > \lim_{x \to 2} f(x),$$

while in the other

$$f(2) < \lim_{x \to 2} f(x).$$

Consequently,



must be the graph of f near the origin.

---

028 10.0 points

Evaluate

$$\lim_{x \to -2} \frac{x+2}{x^2 - 4x - 12}.$$

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

2. limit $= -\frac{1}{8}$ **correct**

3. limit does not exist

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

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

6. limit $= -4$

Explanation:

Since

$$x^2 - 4x - 12 = (x-6)(x+2),$$

the expression above can be rewritten as

$$\frac{x+2}{x^2 - 4x - 12} = \frac{1}{x-6}$$

for $x \neq -2$. Thus

$$\boxed{\lim_{x \to -2} \frac{x+2}{x^2 - 4x - 12} = -\frac{1}{8}}.$$

---

029 10.0 points

Find the value of

$$\lim_{x \to 0} \frac{(3x-2)^2 - 4}{5x}$$

if the limit exists.

1. limit $= -\frac{12}{5}$ **correct**

2. limit $= \frac{12}{5}$

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

4. limit does not exist

5. limit $= -\frac{6}{5}$

Explanation:

After expansion,

$$(3x-2)^2 - 4 = (9x^2 - 12x + 4) - 4.$$

Thus

$$\frac{(3x-2)^2 - 4}{5x} = \frac{x(9x-12)}{5x}$$

$$= \frac{9}{5}x - \frac{12}{5},$$

when $x \neq 0$. Consequently,

$$\boxed{\lim_{x \to 0} \frac{(3x-2)^2 - 4}{5x} = -\frac{12}{5}}.$$

030 10.0 points

Let F be the function defined by

$$F(x) = \frac{x^2 - 9}{|x-3|}.$$

Determine if

$$\lim_{x \to 3^-} F(x)$$

exists, and if it does, find its value.

1. limit does not exist
2. limit $= -3$
3. limit $= 3$
4. limit $= -6$ **correct**
5. limit $= 6$

Explanation:

After factorization,

$$\frac{x^2 - 9}{|x-3|} = \frac{(x+3)(x-3)}{|x-3|}.$$

But, for $x < 3$,

$$|x-3| = -(x-3).$$

Thus

$$F(x) = -(x+3), \quad x < 3,$$

By properties of limits, therefore, the limit exists and

$$\boxed{\lim_{x \to 3^-} F(x) = -6}.$$

031 10.0 points

If the function f defined by

$$f(x) = \begin{cases} cx + 4, & x < 2, \\ 4x^2 - 4, & x \geq 2, \end{cases}$$

is continuous everywhere on $(-\infty, \infty)$, what is the value of $f(1)$?

1. $f(1) = 9$
2. $f(1) = 12$
3. $f(1) = 10$
4. $f(1) = 8$ **correct**
5. $f(1) = 11$

Explanation:

Since f is linear to the left of $x = 2$ and quadratic to the right of $x = 2$, it is certainly continuous on $(-\infty, 2) \cup (2, \infty)$. But at $x = 2$,

$$\lim_{x \to 2-} f(x) = 2c + 4,$$

while

$$\lim_{x \to 2+} f(x) = 16 - 4 = 12,$$

Thus the continuity at $x = 2$ ensures that

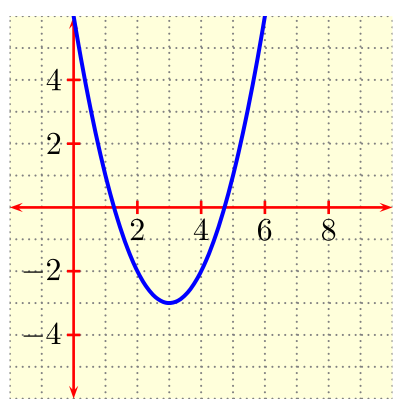
$$2c + 4 = 12, \qquad i.e., \quad c = 4.$$

Consequently,

$$\boxed{f(1) = c + 4 = 8}.$$

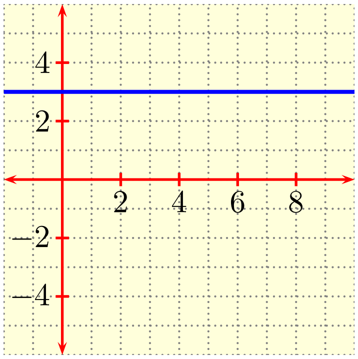
032 10.0 points

If f is a function having

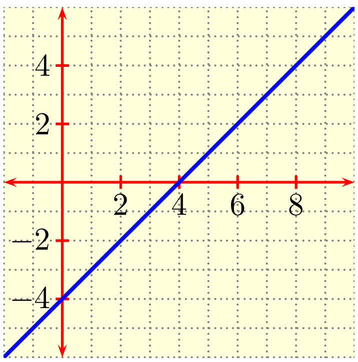


as its graph, which of the following is the graph of the derivative f' of f?

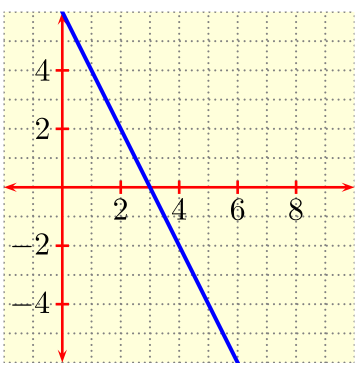
1.



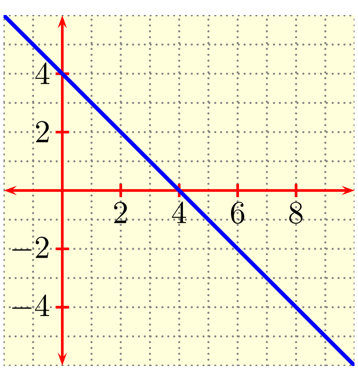
2.



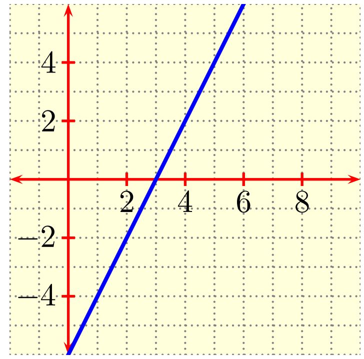
3.



4.



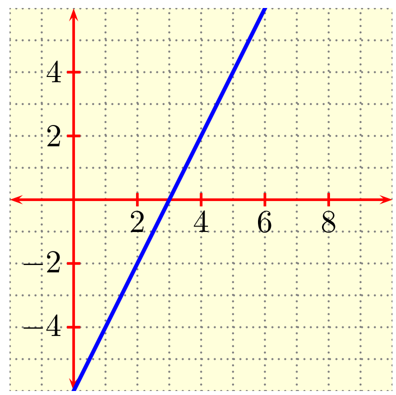
5.



correct

Explanation:

The slope of the tangent to the graph is zero at $x = 3$, is negative to the left of $x = 3$ and is positive to the right of $x = 3$. But it is increasing for all x, so the graph of f' is



033 10.0 points

If the function f is continuous everywhere and

$$f(x) = \frac{x^2 - 9}{x - 3}$$

when $x \neq 3$, find the value of $f(3)$.

1. $f(3) = 3$

2. $f(3) = 6$ **correct**

3. $f(3) = -3$

4. $f(3) = -9$

5. $f(3) = 9$

6. $f(3) = -6$

Explanation:

Since f is continuous at $x = 3$,

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

But, after factorization,

$$\frac{x^2-9}{x-3} = \frac{(x-3)(x+3)}{x-3} = x+3\,,$$

whenever $x \neq 3$. Thus

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

for all $x \neq 3$. Consequently,

$$\boxed{f(3) = \lim_{x \to 3}(x+3) = 6}\,.$$

---

034 (part 1 of 3) 10.0 points

Determine the value of

$$\lim_{x \to 2+} \frac{x-8}{x-2}\,.$$

1. none of the other answers

2. limit $= 4$

3. limit $= \infty$

4. limit $= -4$

5. limit $= -\infty$ **correct**

Explanation:
For $2 < x < 8$ we see that

$$\frac{x-8}{x-2} < 0\,.$$

On the other hand,

$$\lim_{x \to 2+} x-2 = 0\,.$$

Thus, by properties of limits,

$$\boxed{\lim_{x \to 2+} \frac{x-8}{x-2} = -\infty}\,.$$

---

035 (part 2 of 3) 10.0 points

Determine the value of

$$\lim_{x \to 2-} \frac{x-8}{x-2}\,.$$

1. limit $= -\infty$

2. limit $= 4$

3. limit $= \infty$ **correct**

4. none of the other answers

5. limit $= -4$

Explanation:
For $x < 2 < 8$ we see that

$$\frac{x-8}{x-2} > 0\,.$$

On the other hand,

$$\lim_{x \to 2-} x-2 = 0\,.$$

Thus, by properties of limits,

$$\boxed{\lim_{x \to 2-} \frac{x-8}{x-2} = \infty}\,.$$

---

036 (part 3 of 3) 10.0 points

Determine the value of

$$\lim_{x \to 2} \frac{x-8}{x-2}\,.$$

1. limit $= \infty$

2. limit $= 4$

3. limit $= -\infty$

4. limit $= -4$

5. none of the other answers **correct**

Explanation:
If

$$\lim_{x \to 2} \frac{x-8}{x-2}$$

exists, then

$$\lim_{x \to 2+} \frac{x-8}{x-2} = \lim_{x \to 2-} \frac{x-8}{x-2}\,.$$

But as parts (i) and (ii) show,

$$\lim_{x \to 2+} \frac{x-8}{x-2} \neq \lim_{x \to 2-} \frac{x-8}{x-2}.$$

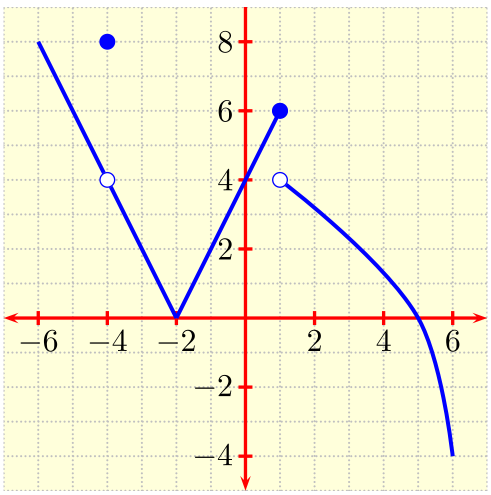
Consequently,

$$\boxed{\lim_{x \to 2} \frac{x-8}{x-2} \text{ does not exist}}.$$

---

037 10.0 points

Below is the graph of a function f.



Use the graph to determine all the values of x on $(-6, 6)$ at which f fails to be continuous.

1. $x = -4, 1$ **correct**

2. none of the other answers

3. $x = 1$

4. $x = -4$

5. no values of x

Explanation:

Since $f(x)$ is defined for all values of x on $(-6, 6)$, the only values of x in $(-6, 6)$ at which the function f is discontinuous are those for which

$$\lim_{x \to x_0} f(x) \neq f(x_0)$$

or

$$\lim_{x \to x_0-} f(x) \neq \lim_{x \to x_0+} f(x).$$

The only possible candidates here are $x_0 = -4$ and $x_0 = 1$. But at $x_0 = -4$

$$f(-4) = 8 \neq \lim_{x \to -4} f(x) = 4,$$

while at $x_0 = 1$

$$\lim_{x \to 1-} f(x) = 6 \neq \lim_{x \to 1+} f(x) = 4.$$

Consequently, on $(-6, 6)$ the function f fails to be continuous only at

$$\boxed{\text{at } x = -4,\ 1}.$$

---

038 10.0 points

Find the solution of the exponential equation

$$4^{15x} = 16^{\frac{9}{2}x-4}.$$

Correct answer: $-8/6$.

Explanation:

By properties of exponents,

$$16^{\frac{9}{2}x-4} = 4^{9x-8}.$$

Thus the equation can be rewritten as

$$4^{15x} = 4^{9x-8},$$

which, after taking logs to the base 4, becomes

$$15x = 9x - 8.$$

Rearranging and solving we thus find that

$$\boxed{x = -8/6.}$$

---

039 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)	644	466	212	116	19	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 $= -38.6$

2. slope $= -19.3$ **correct**

3. slope $= -43.2$

4. slope $= -9.6$

5. slope $= -25.4$

Explanation:

When

$$P = (15, V(15)), \quad Q = (25, V(25))$$

the slope of the secant line PQ is given by

$$\frac{\text{rise}}{\text{run}} = \frac{V(25) - V(15)}{25 - 15}.$$

From the table of values, therefore, we see that

$$\boxed{\text{slope} = \frac{19 - 212}{25 - 15} = -19.3}.$$