1 How is the graph of the equation

$$y^4 = 2x^2 - 3$$

symmetric?

a with respect to the horizontal axis

b with respect to the vertical axis

c with respect to the origin

d all of the above

e none of the above

2 Is the function

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

even or odd?

a even

b odd

c both

d neither

3 Find an equation in (x, y) for the line through the points $(-4, 0)$ and $(1, -5)$.

a $y = -x + 4$

b $y = x + 4$

c $y = x - 4$

d $y = -x - 4$

4 Find both intercepts of the line in the (x, y)-plane with the equation

$$3x - 2y = 5.$$

a $\left(\frac{5}{2}, 0\right)$ and $\left(0, -\frac{5}{3}\right)$

b $\left(-\frac{5}{2}, 0\right)$ and $\left(0, \frac{5}{3}\right)$

c $\left(-\frac{5}{3}, 0\right)$ and $\left(0, \frac{5}{2}\right)$

d $\left(\frac{5}{3}, 0\right)$ and $\left(0, -\frac{5}{2}\right)$

5 Consider these equations:

$$6x - 3y = -1,$$
$$x + 8y = 2.$$

How are their graphs related?

a parallel

b perpendicular

c both

d neither

6 Solve the system of equations

$$\begin{cases} -3x - 8y = -35, \\ -3x + 7y = 25. \end{cases}$$

a $(x, y) = (-1, -4)$

b $(x, y) = (1, -4)$

c $(x, y) = (1, 4)$

d $(x, y) = (-1, 4)$

7 Given

$$f(x) = \frac{x - 2}{x + 4},$$

find $f(0)$.

a $f(0) = 0$

b $f(0) = \frac{1}{2}$

c $f(0) = -\frac{1}{2}$

d $f(0) = 1$

8 Given

$$f(x) = \begin{cases} x + 3 & \text{for } x \leq 0, \\ x - 3 & \text{for } 0 < x < 1, \\ x - 2 & \text{for } x \geq 1, \end{cases}$$

find $f(1)$.

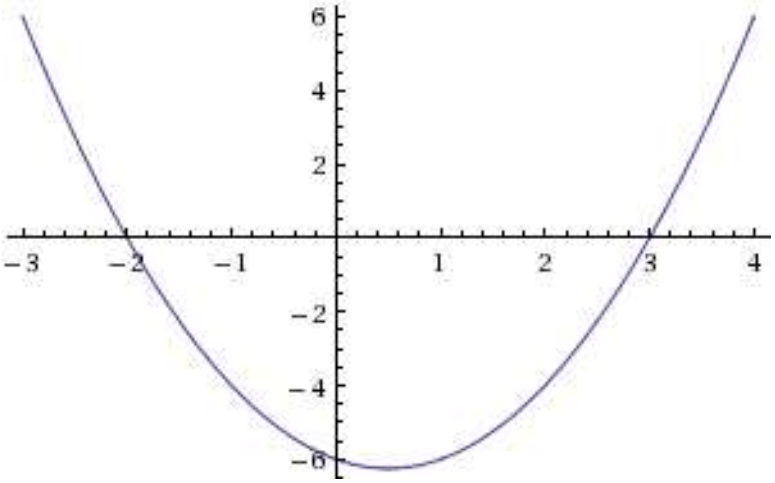
a $f(1) = 4$

b $f(1) = -2$

c $f(1) = -1$

d $f(1)$ is undefined

9 Given that f is the function with the graph below, find $f(2)$.



a $f(2) = -2.2$

b $f(2) = 3.2$

c $f(2) = -4$

d $f(2) = 0$

10 Given

$$f(x) = 3x + 6,$$
$$g(x) = 6x + 3,$$

write down a simplified formula for $f - g$.

a $(f-g)(x) = -3x^2 + 9x$

b $(f-g)(x) = -3x + 9$

c $(f-g)(x) = -3x + 3$

d $(f-g)(x) = -3x^2 + 3x$

11 Given

$$f(x) = x + 6,$$
$$g(x) = x^2,$$

write down a simplified formula for the composite function $f \circ g$.

a $(f \circ g)(x) = x^2 + 36$

b $(f \circ g)(x) = x^2 + 6$

c $(f \circ g)(x) = x^2 + 12x + 36$

d $(f \circ g)(x) = x^3 + 6x^2$

12 Given

$$f(x) = \frac{x+5}{5},$$

write down a simplified formula for the inverse function f^{-1}.

a $f^{-1}(x) = \dfrac{5}{x+5}$

b $f^{-1}(x) = \dfrac{5}{x-5}$

c $f^{-1}(x) = 5x + 5$

d $f^{-1}(x) = 5x - 5$

13 Given

$$g(x) = \sqrt{x-2},$$

what is the domain of g?

a $\{x \mid x > -2\} = (-2, \infty)$

b $\{x \mid x \geq 2\} = [2, \infty)$

c $\{x \mid x > 2\} = (2, \infty)$

d $\{x \mid x \geq -2\} = [-2, \infty)$

14 Given

$$g(x) = \sqrt{x-2},$$

what is the range of g?

a $\{x \mid x \geq -2\} = [-2, \infty)$

b $\{x \mid x \geq 0\} = [0, \infty)$

c $\mathbb{R} = (-\infty, \infty)$

d $\{x \mid x \geq 2\} = [2, \infty)$

15 Given

$$g(x) = \sqrt{x-2},$$

What is the average rate of change of g from 3 to 11?

a $\dfrac{1}{4}$

b 4

c $-\dfrac{1}{4}$

d -4

16 Given

$$f(x) = 3x^2 - 12x + 9,$$

what is the vertex of the graph of f?

a $(-2, 45)$

b $(0, 9)$

c $(1, 0)$

d $(2, -3)$

17 Solve the equation

$$2^{x+3} = 4^{2x}.$$

a $x = 0$

b $x = \ln 2 \approx 0.7$

c $x = \log_2 3 \approx 1.6$

d $x = 1$

18 Given

$$f(x) = 3x^2 - 12x + 9,$$

what are the roots (zeroes) of f, if any?

a 1

b 3

c both of the above

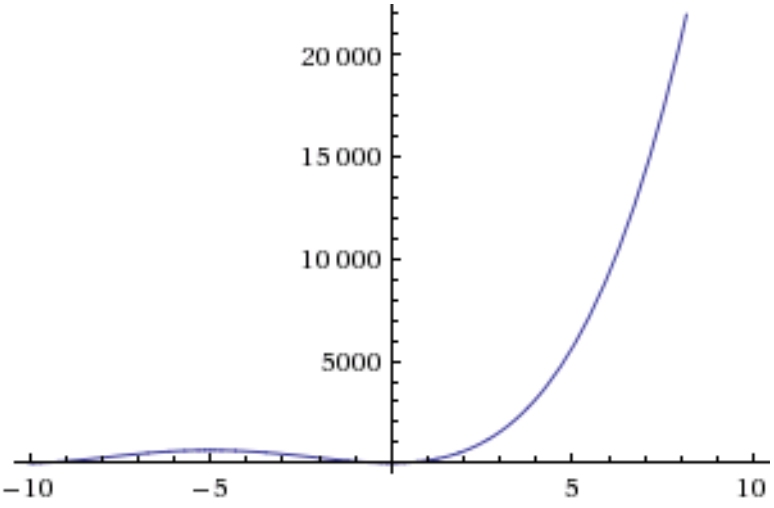
d neither of the above

19 Given

$$f(x) = x^4 + 20x^3 + 100x^2,$$

sketch a graph of f that shows all intercepts (if any), all turning points (if any), and the end behaviour.

a



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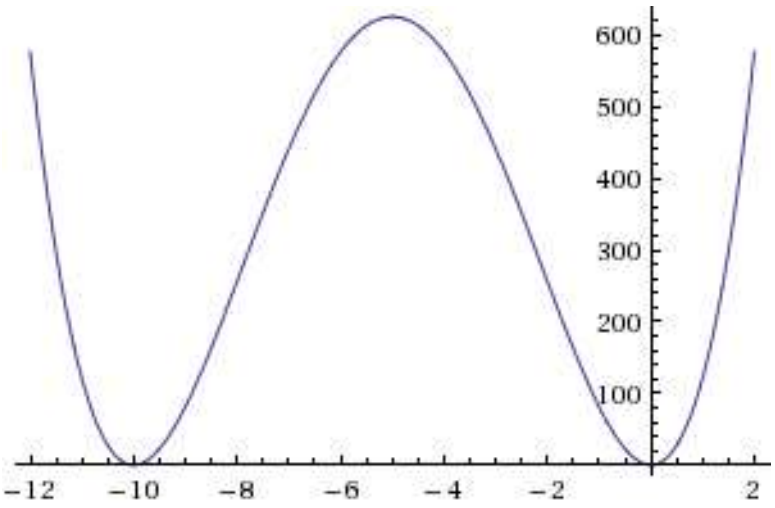
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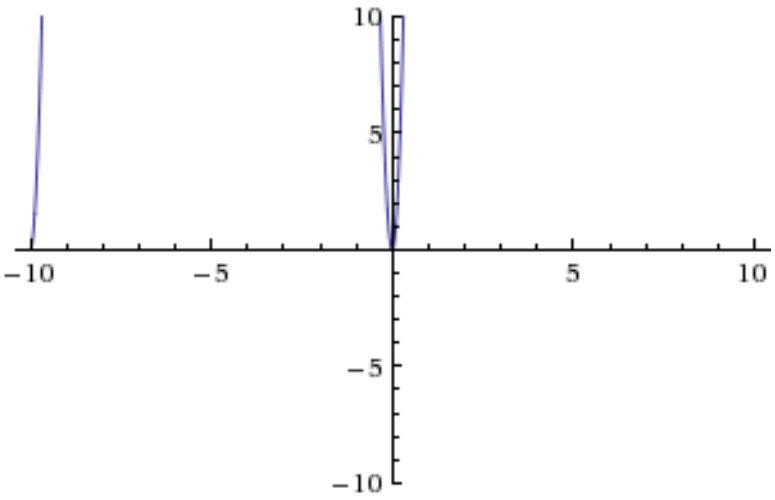
2

c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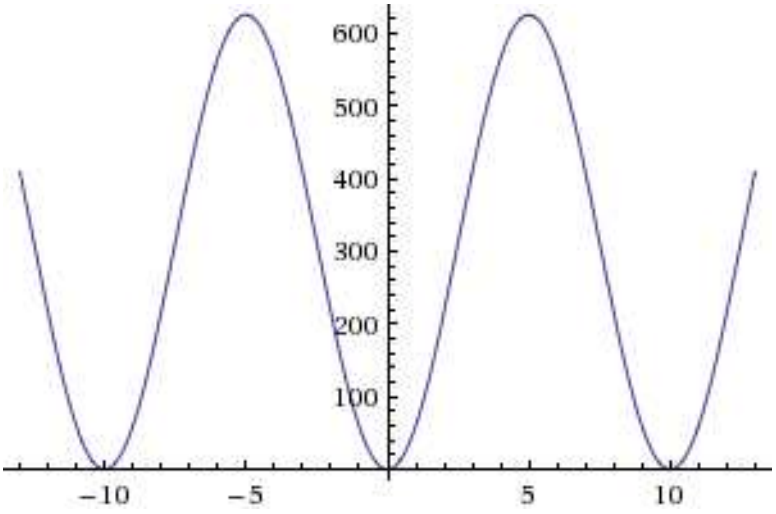
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20 Given

$$f(x) = x^3 - 2x^2 - 4x + 8,$$

what is the multiplicity of the root (zero) 2?

a 0

b 1

c 2

d 3

21 Solve the equation

$$x^4 + x^3 + 2x^2 + 4x = 8$$

in the complex numbers.

a $x = 2$ or $x = -2\mathrm{i}$ or $x = -1$

b $x = -2$ or $x = 1$ or $x = -2\mathrm{i}$ or $x = 2\mathrm{i}$

c $x = 2\mathrm{i}$ or $x = -2$ or $x = 1$

d $x = 2$ or $x = -1$ or $x = 2\mathrm{i}$ or $x = -2\mathrm{i}$

22 Suppose that the unit price at which x items can be sold in a year is $1000 - x$ dollars. How many items should be sold in a year to maximise revenue? (Hint: First find a quadratic function for annual revenue as a function of the number of items, remembering that revenue is quantity times price.)

a 500

b 1000

c 250

d 300

23 While I was in graduate school, I didn't pay anything on my undergraduate loans. However, those loans continued to accrue interest at a 6% annual rate, compounded monthly. At the end of my six years of graduate school, I owed $20,000 (approximately) on these loans. What was the original amount of the loan (approximately) that I owed *before* I started graduate school?

a $13,000

b $14,000

c $18,000

d $19,000

24 Using a central-pivot irrigation system, a farmer irrigates a circular patch within a square field. The size of the field is fixed; the farmer irrigates the largest possible circle within that field. Express the area that the system irrigates as a function of the total area of the field.

Hints: The area of a circle is πr^2, where π is a constant (approximately 3.14) and r is the radius of the circle (the distance from its centre to its edge). The area of a square is l^2, where l is the length of any side of the square. A picture may help you see the relationship between the size of the circle (given by r) and the size of the square (given by l).

a $f(x) = \dfrac{\pi^2}{16}x^2 \approx 0.617x^2$

b $f(x) = \dfrac{\pi^2}{16}x \approx 0.617x$

c $f(x) = \frac{\pi}{4}x^2 \approx 0.785x^2$

d $f(x) = \frac{\pi}{4}x \approx 0.785x$

25 Fill in the blank: A point on a graph that is also on at least one of the coordinate axes is a(n) _____ of that graph.

26 If an equation in the variables x and y can be solved uniquely for y, then it defines y as a(n) _____ of x.

27 If $f(c) = 0$, then c is a(n) _____ of f.

28 If $f(a) = f(b)$ for all a and b, then f is a(n) _____ function.

29 A(n) _____ of a function is either a minimum or a maximum.

30 If $f(x) = mx + b$ for all x, then m is the _____ of f.

31 If $f\big(g(x)\big) = x$ for all x in the domain of g and $g\big(f(x)\big) = x$ for all x in the domain of f, then g is the _____ of f.

32 If $f(x) = ax^2 + bx + c$ for all x, then f is a(n) _____ function.

33 If $u = b^x$, $b > 0$, and $b \neq 1$, then x is the _____, base b, of u.

Answers

1 D, 2 A, 3 D, 4 D, 5 D, 6 C, 7 C, 8 C, 9 C, 10 C, 11 B, 12 D, 13 B, 14 B, 15 A, 16 D, 17 D, 18 C, 19 B, 20 C, 21 B, 22 A, 23 B, 24 D.

25 intercept

26 function

27 root (or zero)

28 constant

29 extremum (or extreme value)

30 rate of change (*not* slope)

31 inverse (or inverse function)

32 quadratic

33 logarithm