

- 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, odd, or neither?

- a even
- b odd
- c 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:

$$\begin{aligned}6x - 3y &= -1, \\ x + 8y &= 2.\end{aligned}$$

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  $f(0) = 1$

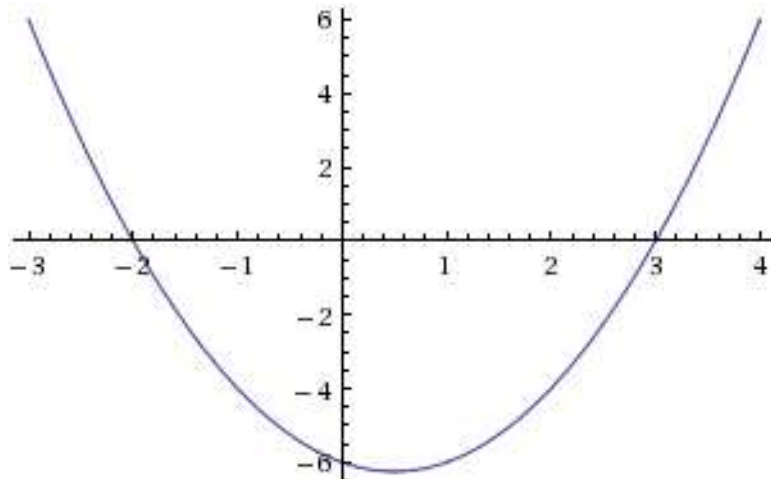
8 Given

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

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

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

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  $\frac{1}{4}$

b 4

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

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

$$f(x) = 2x^2 - 3x + 1,$$

sketch a graph of  $f$ , showing all intercepts (if any).

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  $x = -2i$  or  $x = -1$

b  $x = -2$  or  $x = 1$  or  $x = -2i$  or  $x = 2i$

c  $x = 2i$  or  $x = -2$  or  $x = 1$

d  $x = 2$  or  $x = -1$  or  $x = 2i$  or  $x = -2i$

22 Given

$$f(x) = \frac{x^2 - 4}{x^2 - 5x + 6},$$

what are the vertical asymptotes of  $f$ ?

a  $x = 3$

b  $x = 2$

c both

d neither

- 23** 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
- 24** 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
- 25** 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  $\pi r^2$ , where  $\pi$  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*  $f(x) = \frac{\pi^2}{16}x^2 \approx 0.617x^2$
  - b*  $f(x) = \frac{\pi^2}{16}x \approx 0.617x$
  - c*  $f(x) = \frac{\pi}{4}x^2 \approx 0.785x^2$
  - d*  $f(x) = \frac{\pi}{4}x \approx 0.785x$

**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, 20 C, 21 B, 22 A, 23 A, 24 B, 25 D.

19

