**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:

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

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 $f(1)$.

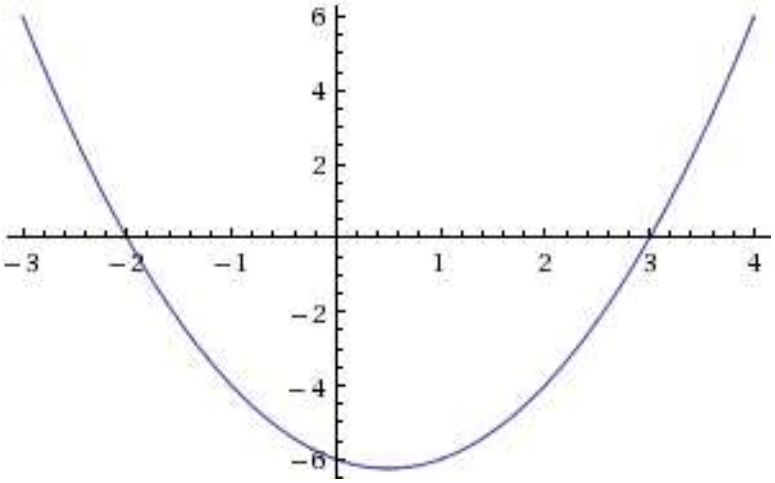
*a* $f(1) = 4$

*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

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

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

*a* 0

*b* 1

*c* 2

*d* 3

**20** Solve the equation

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

in the real numbers.

*a* $x = 2$ or $x = -2$ or $x = -1$

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

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

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

**21** 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

**22** 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

**23** 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, 19 C, 20 B, 21 A, 22 B, 23 D.