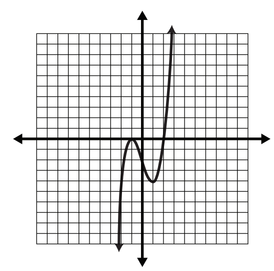
Math 30-1: Polynomial, Radical, and Rational Functions
PRACTICE EXAM

1. A zero of the polynomial function $P(x) = x^2 - 4x - 5$ is:

A. -2
B. -1
C. 0
D. 1

2. Given the graph of $P(x) = (x + 1)^2(x - 2)$, the zeros and their multiplicities are:

A. -2 (multiplicity = 1); -1 (multiplicity = 1); 2 (multiplicity = 1)
B. -1 (multiplicity = 1); 2 (multiplicity = 2)
C. -1 (multiplicity = 2); 2 (multiplicity = 1)
D. 0 (multiplicity = -2)



3. The y-intercept of $P(x) = \frac{1}{2}(x - 5)(x + 3)$ is found at the point:

A. $\left(0, -\frac{15}{2}\right)$
B. $\left(0, -\frac{13}{2}\right)$
C. (0, -3)
D. (0, 5)

4. The graph of $P(x) = -x^2(x + 1)$:

A. Trends upwards linearly from Quadrant III to Quadrant I.
B. Trends parabolically from Quadrant II to Quadrant I.
C. Trends downwards linearly from Quadrant II to Quadrant IV.
D. Trends parabolically from Quadrant III to Quadrant IV.

5. The polynomial function P(x) = x(4x - 3)(3x + 2) has zeros of:

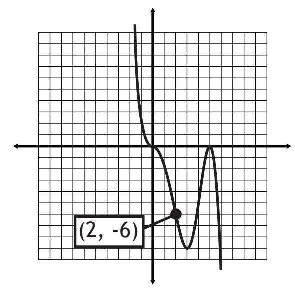
A. -2, 0, 3

B. $-\frac{4}{3}, 0, \frac{3}{2}$

C. $-\frac{3}{4}, 0, \frac{2}{3}$

D. $-\frac{2}{3}, 0, \frac{3}{4}$

6. The polynomial function corresponding to the graph is:



A. $P(x) = -x^3(x-5)^2$

B. $P(x) = -6x(x-5)^2$

C. $P(x) = -\frac{1}{3}x^2(x-5)$

D. $P(x) = -\frac{1}{12}x^3(x-5)^2$

7. The polynomial function that matches the given characteristics of P(x) is:

Characteristics of P(x)

x-intercepts: (-1, 0) and (3, 0)
sign of leading coefficient: (+)
polynomial degree: 4
relative maximum at (1, 8)

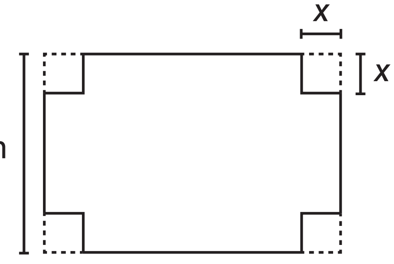
A. $P(x) = \frac{1}{2}(x-1)^2(x+3)^2$

B. $P(x) = \frac{1}{2}(x+1)^2(x-3)^2$

C. $P(x) = 4(x-1)^2(x+3)^2$

D. $P(x) = 4(x+1)^2(x-3)^2$

8. A box with no lid can be made by cutting out squares from each corner of a rectangular piece of cardboard and folding up the sides. A particular piece of cardboard has a length of 20 cm and a width of 16 cm. The side length of a corner square is *x*.
The volume function and its domain are:



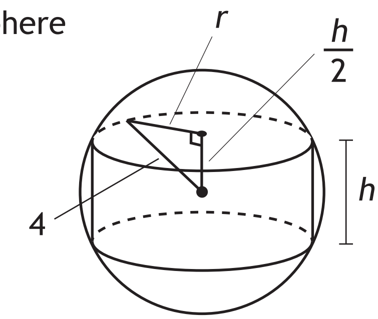
A. V(x) = x(20 - x)(16 - x); Domain: {x | 0 < x ≤ 4, x ε R}

B. V(x) = x(20 - x)(16 - x); Domain: (0, 4)

C. V(x) = x(20 - 2x)(16 - 2x); Domain: (0, 8)

D. V(x) = x(20 - 2x)(16 - 2x); Domain: {x | 0 ≤ x ≤ 8, x ε R}

9. A cylinder with a radius of *r* and a height of *h* is inscribed within a sphere that has a radius of 4 units. The polynomial function, V(h), that expresses the volume of the cylinder as a function of its height is:



$V_{cylinder} = \pi r^2 h$

A. $V(r) = \pi r^2 \sqrt{16 - r^2}$

B. $V(h) = \pi(16h - h^3)$

C. $V(h) = \pi h^3$

D. $V(h) = \frac{1}{4}\pi(64h - h^3)$

10. A partially completed polynomial division is shown. The next step in the long division process is to:

Partially completed long division.

$$\begin{array}{r|l} & \quad x^2 \\ x + 2 & x^3 + 2x^2 - 5x - 6 \\ \ominus & x^3 + 2x^2 \\ \hline & \qquad\quad - 5x - 6 \end{array}$$

A. Add 5 in the quotient.

B. Subtract 5 in the quotient.

C. Add 5x in the quotient.

D. Subtract 5x in the quotient.

11. $(x^3 - 1) \div (x + 2)$, expressed in the form $\frac{P(x)}{D(x)} = Q(x) + \frac{R}{D(x)}$, is:

A. $\frac{x^3 - 1}{x + 2} = x^2 - 2x + 4 - \frac{9}{x + 2}$

B. $\frac{x^3 - 1}{x + 2} = x^2 + 2x - 4 + \frac{9}{x + 2}$

C. $\frac{x^3 - 1}{x + 2} = x + \frac{1}{x + 2}$

D. $\frac{x^3 - 1}{x - 2} = x^2 + 2x - 4 + \frac{9}{x - 2}$

12. The correct synthetic division of $(3x^3 - x - 3) \div (x - 1)$ is:

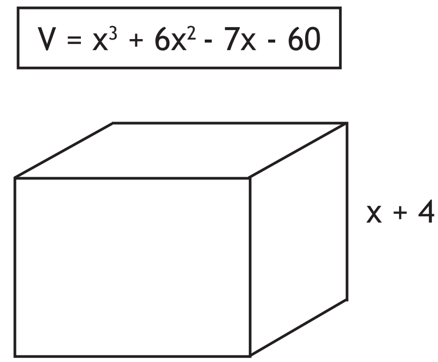
A.
$$\begin{array}{r|rrrr} -1 & 3 & 0 & -1 & -3 \\ \oplus & & -3 & 3 & -2 \\ \hline & 3 & -3 & 2 & -5 \end{array}$$

B.
$$\begin{array}{r|rrr} -1 & 3 & -1 & -3 \\ \ominus & & -3 & -2 \\ \hline & 3 & 2 & -1 \end{array}$$

C.
$$\begin{array}{r|rrrr} -1 & 3 & 0 & -1 & -3 \\ \ominus & & -3 & -3 & -2 \\ \hline & 3 & 3 & 2 & -1 \end{array}$$

D.
$$\begin{array}{r|rrrr} 1 & 3 & 0 & -1 & -3 \\ \ominus & & 3 & -3 & 2 \\ \hline & 3 & -3 & 2 & -5 \end{array}$$

13. A rectangular prism has a volume of $x^3 + 6x^2 - 7x - 60$. If the height of the prism is $x + 4$, the dimensions of the base are:



A. $(x + 5)$ and $(x - 3)$

B. $(x - 5)$ and $(x - 4)$

C. $(x - 1)$ and $(x + 1)$

D. $(x + 2)$ and $(x + 3)$

14. When $2x^3 - x^2 - 3x - 2$ is divided by $x - 1$, the remainder is:

A. P(-1)

B. P(0)

C. P(1)

D. 0

15. When P(x) is divided by $x - a$, the factor theorem tells us that $x - a$ is a factor of the polynomial when:

A. $P(0) = a$

B. $P(x - a) = 0$

C. $P(-a) = 0$

D. $P(a) = 0$

16. If $\dfrac{3x^3 - 6x^2 + 2x + k}{x - 2}$ has a remainder of -3, then the value of k is:

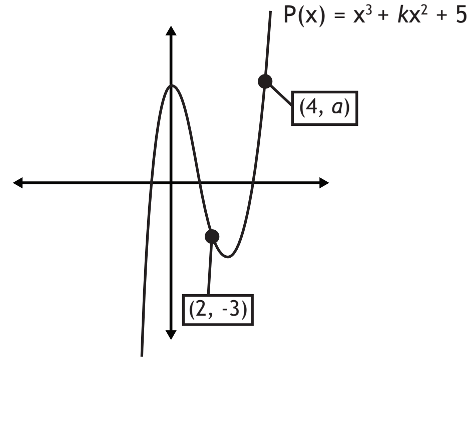
A. -7

B. -2

C. 2

D. 7

17. Given the graph of $P(x) = x^3 + kx^2 + 5$ and the points (2, -3) and (4, a), the value of a is:



A. -4

B. 0

C. 1

D. 5

18. Potential zeros of the polynomial function $P(x) = x^3 + x^2 - 5x + 3$ are:

A. 0, 1, 3
B. -3, -1, 0
C. 0, ±1, ±3
D. ±1, ±3

19. The factored form of $P(x) = x^3 + 3x^2 - x - 3$ is:

A. $P(x) = (x + 3)(x + 1)(x - 1)$
B. $P(x) = (x + 3)(x^2 + 1)$
C. $P(x) = (x - 1)^2(x - 3)$
D. $P(x) = (x + 1)^2(x - 3)$

20. The factored form of $P(x) = x^3 - 3x + 2$ is:

A. $P(x) = (x - 2)^2(x + 1)$
B. $P(x) = (x + 2)^2(x - 1)$
C. $P(x) = (x + 2)(x - 1)^2$
D. $P(x) = (x - 2)(x - 1)^2$

21. The factored form of $P(x) = x^4 - 16$ is:

A. $P(x) = (x - 4)(x + 4)$
B. $P(x) = (x^2 + 4)(x + 2)$
C. $P(x) = (x^2 + 4)(x + 2)^2$
D. $P(x) = (x^2 + 4)(x - 2)(x + 2)$

22. The polynomial function P(x) has zeros of -4, 0, 0, and 1, and the graph passes through the point (-1, -3). The polynomial function is:

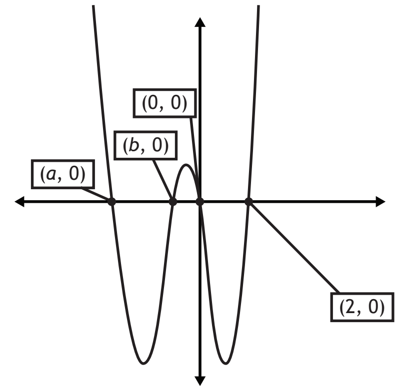
A. $P(x) = \frac{1}{2}x^2(x - 4)(x + 1)$

B. $P(x) = \frac{1}{2}x^2(x + 4)(x - 1)$

C. $P(x) = 2x^2(x - 4)(x + 1)$

D. $P(x) = \frac{1}{3}x^2(x + 4)(x - 1)$

23. Given the graph of $P(x) = x^4 + 2x^3 - 5x^2 - 6x$ and various points on the graph, the values of *a* and *b* are:



A. a = -6, b = -2

B. a = -5, b = -2

C. a = -4, b = -1

D. a = -3, b = -1

24. Which of the following is **not** a solution to $3x^3 + 8x^2 + 4x - 1 = 0$?

A. $x = \dfrac{-5 - \sqrt{37}}{6}$

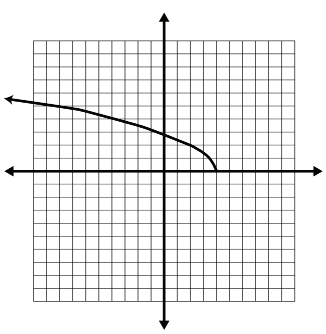
B. $x = -1$

C. $x = 1$

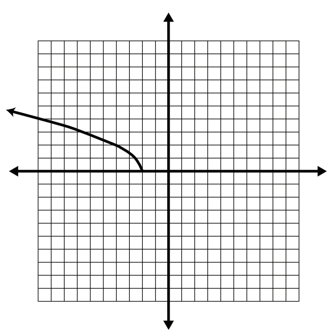
D. $x = \dfrac{-5 + \sqrt{37}}{6}$

25. The graph of $f(x) = \sqrt{-2x - 4}$ is:

A.



B.



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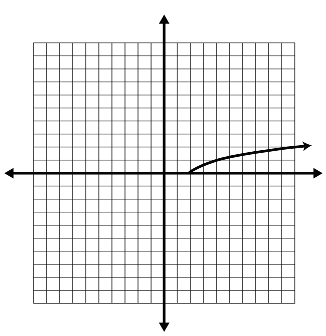
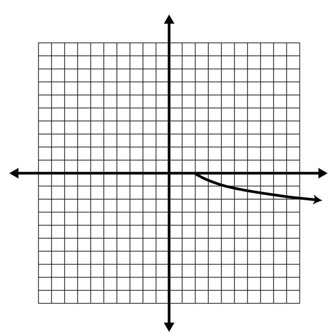
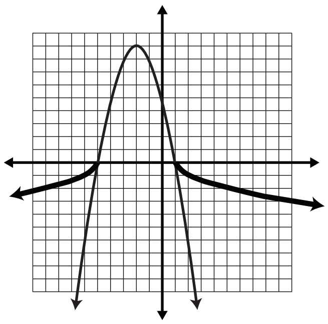


D.

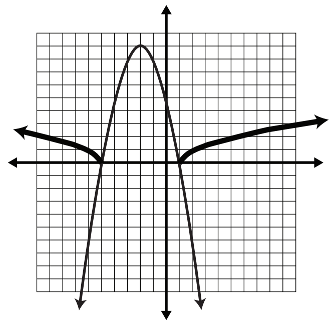


26. Given the graph of $f(x) = -(x + 2)^2 + 9$, the graph of $y = \sqrt{f(x)}$ is:

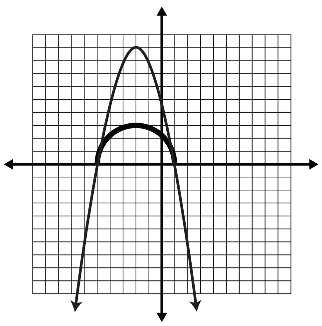
A.



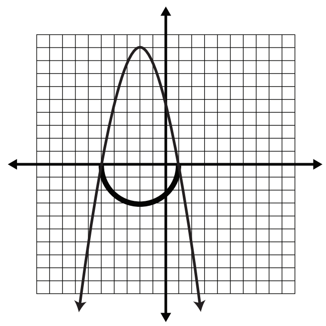
B.



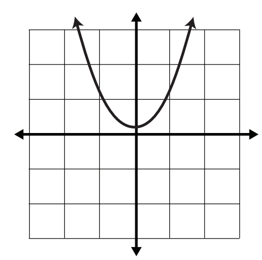
C.



D.



27. Given the graph of $f(x) = x^2 + 0.25$, the range of $y = \sqrt{f(x)}$ is:



A. $\{y \mid y \geq 0.125, y \in R\}$
B. $(0.125, \infty)$
C. $\{y \mid y \geq 0.5, y \in R\}$
D. $(0.5, \infty)$

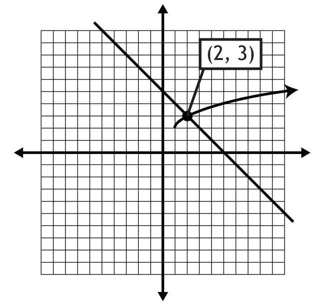
28. The radical equation $x = \sqrt{x + 2}$ has:

A. Two solutions, at $x = -2$ and $x = 1$.
B. Two solutions, at $x = -1$ and $x = 2$.
C. Only one solution at $x = 1$, because $x = -2$ is an extraneous root.
D. Only one solution at $x = 2$, because $x = -1$ is an extraneous root.

29. The radical equation $\sqrt{16 - x^2} = 5$ has:

A. No solutions, because $\sqrt{16 - x^2} = 5$ cannot be solved algebraically.
B. No solutions, because $y_1 = \sqrt{16 - x^2}$ and $y_2 = 5$ have no point of intersection.
C. No solutions, because $y = \sqrt{16 - x^2} - 5$ has no x-intercept.
D. No solutions. A, B, and C are all true.

30. An equation that can be used to find the point of intersection (2, 3) in the graphs shown is:



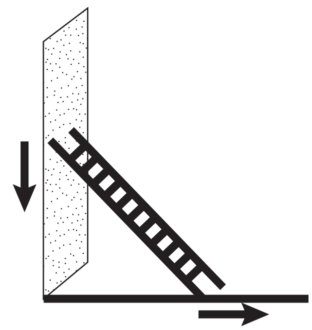
A. $\sqrt{x+1} - 2 = -x + 5$

B. $\sqrt{x+1} - 2 = x - 5$

C. $\sqrt{x-1} + 2 = -x + 5$

D. $\sqrt{x-1} + 2 = x + 5$

31. A ladder that is 3 m long is leaning against a wall. The base of the ladder is *d* metres from the wall, and the top of the ladder is *h* metres above the ground. The height of the ladder as a function of its base distance *d* is:



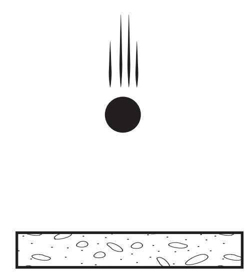
A. $h(d) = \sqrt{3 - d^2}$

B. $h(d) = \sqrt{3} - d$

C. $h(d) = 9 - d^2$

D. $h(d) = \sqrt{9 - d^2}$

32. If a ball at a height of *h* metres is dropped, the length of time it takes to hit the ground is:



$$t = \sqrt{\frac{h}{4.9}}$$

where *t* is the time in seconds.

If a ball is dropped from one-quarter of its original height, how will that change the time it takes to fall?

A. The time to fall is one-quarter the original time.

B. The time to fall is one-half the original time.

C. The time to fall is double the original time.

D. The time to fall is quadruple the original time.

33. The rational function $f(x) = \dfrac{1}{x^2 - 2x - 24}$ has vertical asymptotes at:

A. $x = -4$ and $x = 6$.

B. $x = 4$ and $x = -6$.

C. $y = -4$ and $y = 6$.

D. $y = 4$ and $y = -6$.

34. Compared to the graph of $y = \dfrac{1}{x}$, the graph of $y = \dfrac{3}{x + 4}$ is:

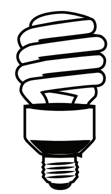
A. Vertically stretched by a scale factor of 3 and horizontally translated 4 units right.

B. Vertically stretched by a scale factor of 3 and horizontally translated 4 units left.

C. Horizontally stretched by a scale factor of 3 and horizontally translated 4 units right.

D. Horizontally stretched by a scale factor of 3 and horizontally translated 4 units left.

35. The illuminance of light can be described with the reciprocal-square relation:



$$I(d) = \frac{S}{4\pi d^2}$$

where *I* is the illuminance (SI unit = lux), *S* is the amount of light emitted by a source (SI unit = lumens), and *d* is the distance of a screen from the light source in metres. If the original distance of the screen from the bulb is tripled, how does the illuminance change?

A. The illuminance is one-ninth the original illuminance.

B. The illuminance is one-third the original illuminance.

C. The illuminance is three times the original illuminance.

D. The illuminance is nine times the original illuminance.

36. The graph of $y = \dfrac{x + 4}{x^2 - 16}$ has:

A. Vertical asymptotes at $x = \pm 4$ and a horizontal asymptote at $y = 0$.

B. Vertical asymptotes at $x = \pm 4$ and a horizontal asymptote at $y = 1$.

C. A vertical asymptote at $x = -4$, a hole when $x = 4$, and a horizontal asymptote at $y = 0$.

D. A vertical asymptote at $x = 4$, a hole when $x = -4$, and a horizontal asymptote at $y = 0$.

37. The graph of $y = \dfrac{3x^2}{x^2 + 9}$ has:

A. No vertical asymptotes and a horizontal asymptote at $y = 3$.

B. Vertical asymptotes at $x = \pm 3$ and a horizontal asymptote at $y = 0$.

C. Vertical asymptotes at $x = \pm 3$ and a horizontal asymptote at $y = 3$.

D. Holes when $x = \pm 3$ and a horizontal asymptote at $y = 3$.

38. The graph of $y = \dfrac{x^2 - 5x + 6}{x - 2}$ has:

A. No vertical asymptotes and a hole at (2, -1).

B. No vertical asymptotes and a hole at (3, 0).

C. A vertical asymptote at x = 2.

D. A vertical asymptote at x = 3.

39. The graph of a rational function has a vertical asymptote at x = 0, a horizontal asymptote at y = 0, no x-intercepts, and a hole at (-1, -1). The rational function is:

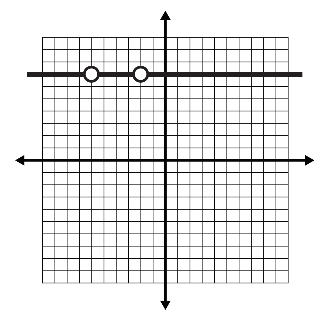
A. $y = \dfrac{x-2}{x(x-2)}$

B. $y = \dfrac{x+2}{x(x-2)}$

C. $y = \dfrac{x+1}{x(x+1)}$

D. $y = \dfrac{x}{x(x-1)}$

40. The rational function corresponding to the graph shown is:



A. $y = \dfrac{7}{(x-6)(x-2)}$

B. $y = \dfrac{7}{(x+6)(x+2)}$

C. $y = \dfrac{7(x-6)(x-2)}{(x-6)(x-2)}$

D. $y = \dfrac{7(x+6)(x+2)}{(x+6)(x+2)}$

41. The rational equation $\dfrac{6}{x} - \dfrac{9}{x - 1} = -6$ has:

A. Two solutions. Solving the equation algebraically yields x = -0.5 and x = 2.

B. Two solutions. The equations $y_1 = \dfrac{6}{x} - \dfrac{9}{x-1}$ and $y_2 = -6$ have points of intersection when x = -0.5 and x = 2.

C. Two solutions. The equation $y = \dfrac{6}{x} - \dfrac{9}{x-1} + 6$ has x-intercepts when x = -0.5 and x = 2.

D. Two solutions. A, B, and C are all true.

42. George can canoe 24 km downstream and return to his starting position (upstream) in 5 h. The speed of the current is 2 km/h. What is the speed of the canoe in still water?

A rational equation that can be used to solve this problem is:

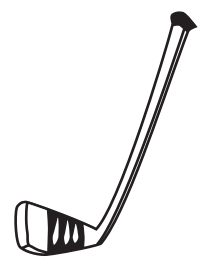
A. $\frac{24}{x-2} - \frac{24}{x+2} = 5$

B. $\frac{24}{x-2} + \frac{24}{x+2} = 5$

C. $\frac{5}{x-2} - \frac{5}{x+2} = 24$

D. $\frac{2}{x-5} + \frac{2}{x+5} = 24$

43. The shooting percentage of a hockey player is ratio of scored goals to total shots on goal. So far this season, Laura has scored 2 goals out of 14 shots taken. Assuming Laura scores a goal with every shot from now on, how many goals will she need to have a 40% shooting percentage?



A rational equation that can be used to solve this problem is:

A. $0.40 = \frac{2+x}{14+x}$

B. $0.40 = \frac{2-x}{14-x}$

C. $0.60 = \frac{2+x}{14+x}$

D. $0.60 = \frac{2-x}{14-x}$

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Polynomial, Radical, and Rational Functions Practice Exam - ANSWER KEY

Video solutions are in italics.

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1. **B** *Polynomial Functions, Example 3a*
2. **C** *Polynomial Functions, Example 4e*
3. **A** *Polynomial Functions, Example 5a (ii)*
4. **C** *Polynomial Functions, Example 5b (iii)*
5. **D** *Polynomial Functions, Example 7b (i)*
6. **D** *Polynomial Functions, Example 9a*
7. **B** *Polynomial Functions, Example 12a*
8. **C** *Polynomial Functions, Example 13 (a, b)*
9. **D** *Polynomial Functions, Example 16*
10. **B** *Polynomial Division, Example 1a*
11. **A** *Polynomial Division, Example 2c*
12. **C** *Polynomial Division, Example 3a*
13. **A** *Polynomial Division, Example 6*
14. **C** *Polynomial Division, Example 9b*
15. **D** *Polynomial Division, Example 10d*
16. **A** *Polynomial Division, Example 12b*
17. **D** *Polynomial Division, Example 15*
18. **D** *Polynomial Factoring, Example 1b*
19. **A** *Polynomial Factoring, Example 2a*
20. **C** *Polynomial Factoring, Example 4a*
21. **D** *Polynomial Factoring, Example 7a*
22. **B** *Polynomial Factoring, Example 9a*
23. **D** *Polynomial Factoring, Example 13*
24. **C** *Polynomial Factoring, Example 14b*
25. **B** *Radical Functions, Example 5d*
26. **C** *Radical Functions, Example 6b*
27. **C** *Radical Functions, Example 8b*
28. **D** *Radical Functions, Example 10*
29. **D** *Radical Functions, Example 12*
30. **C** *Radical Functions, Example 13b*
31. **D** *Radical Functions, Example 14a*
32. **B** *Radical Functions, Example 15a*
33. **A** *Rational Functions I, Example 6b*
34. **B** *Rational Functions I, Example 7c*
35. **A** *Rational Functions I, Example 10b*
36. **D** *Rational Functions II, Example 1c*
37. **A** *Rational Functions II, Example 2c*
38. **A** *Rational Functions II, Example 7*
39. **C** *Rational Functions II, Example 8b*
40. **D** *Rational Functions II, Example 9c*
41. **D** *Rational Functions II, Example 11*
42. **B** *Rational Functions II, Example 14*
43. **A** *Rational Functions II, Example 15*

Math 30-1 Practice Exam: Tips for Students

• Every question in the practice exam has already been covered in the Math 30-1 workbook. It is recommended that students refrain from looking at the practice exam until they have completed their studies for the unit.

• Do not guess on a practice exam. The practice exam is a self-diagnostic tool that can be used to identify knowledge gaps. Leave the answer blank and study the solution later.