PSU Math Relays 2019 **Potpourri** 60 Questions

Select the letter of the most appropriate answer and shade in the corresponding region on the anwser sheet. If no answer seems appropriate then shade in region E on the answer sheet.

Evaluate the algebraic expression for the given value or values of the variable(s).

1) $x^2 - 3(x - y)$; $x = 8$ and $y = 2$

A) 38 B) 46 C) 42 D) -82

2) $\frac{7(x + 1)}{2x + 4}$; $x = 5$

A) 2 B) 3 C) 6 D) $\frac{7}{2}$

Solve.

3) A stone is dropped from a tower that is 740 feet high. The formula $h = 740 - 16t^2$ describes the stone's height above the ground, h, in feet, t seconds after it was dropped. What is the stone's height 5 seconds after it is released?

A) 365 ft B) 340 ft C) 350 ft D) 315 ft

4) If a rock falls from a height of 70 meters above the ground, the height H (in meters) after x seconds can be approximated using the formula $H = 70 - 4.9x^2$. What is the height of the rock after 3 seconds?

A) 585.9 m B) -146.09 m C) 55.3 m D) 25.9 m

Find the intersection of the two sets.

5) $\{6, 8, 9, 11\} \cap \varnothing$

A) $\{9, 11\}$ B) $\varnothing$ C) $\{6, 8\}$ D) $\{6, 8, 9, 11\}$

6) $\{1, 3, 9\} \cap \{5, 6\}$

A) $\varnothing$ B) $\{1, 5, 9, 3, 6\}$ C) $\{3, 9\}$ D) $\{1, 9\}$

Find the union of the two sets.

7) $\{1, 11\} \cup \{1, 4, 9\}$

A) $\{1\}$ B) $\varnothing$ C) $\{1, 4, 9, 11\}$ D) $\{4, 9, 11\}$

8) $\{4, 6, 7, 9\} \cup \varnothing$

A) $\{7, 9\}$ B) $\{4, 6, 7, 9\}$ C) $\varnothing$ D) $\{4, 6\}$

List all numbers from the given set B that are members of the given Real Number subset.

9) $B = \{17, \sqrt{7}, -15, 0, 0.\overline{7}, \sqrt{9}\}$ Whole numbers

A) $17, -15, 0, \sqrt{9}$ B) $17, 0, \sqrt{9}$ C) $17, -15, 0$ D) $17, 0$

Rewrite the expression without absolute value bars.

10) $|3 + (-8)|$

A) 11 B) -11 C) -5 D) 5

11) $|\sqrt{6} - 17|$

A) $\sqrt{6} - 17$ B) 11 C) $17 - \sqrt{6}$ D) -11

State the name of the property illustrated.

12) $18 + (15 + 9) = (18 + 15) + 9$

A) Commutative property of addition
B) Associative property of addition
C) Identity property of addition
D) Distributive property of multiplication over addition

13) $5(x + 3) = 5x + 5 \cdot 3$

A) Distributive property of multiplication over addition
B) Identity property of multiplication
C) Associative property of multiplication
D) Commutative property of multiplication

Simplify the algebraic expression.

14) $(9z + 10) - (2z - 8)$

A) $7z + 18$ B) $11z + 18$ C) $7z - 18$ D) $7z + 2$

Write the algebraic expression without parentheses.

15) $-(-7 + 7y)$

A) $-7 + 7y$ B) $7 - 7y$ C) $49y$ D) $7 + 7y$

Evaluate the exponential expression.

16) $(-7)^0$

A) 1 B) 7 C) -1 D) 0

17) $(-3)^{-4}$

A) $-\frac{1}{81}$ B) 81 C) -81 D) $\frac{1}{81}$

Simplify the exponential expression.

18) $x^9 \cdot x^{-3}$

A) $-x^6$ B) $-\frac{1}{x^6}$ C) x^6 D) $\frac{1}{x^6}$

19) $(x^{-3})^6$

A) $\frac{1}{x^{18}}$ B) $-3x^6$ C) $-x^{18}$ D) $-3x^{18}$

Write the number in decimal notation without the use of exponents.

20) 9×10^{-3}

A) 9000 B) 900 C) 0.009 D) 0.09

Write the number in scientific notation.

21) 0.00002686

A) 2.686×10^{-4} B) 2.686×10^4 C) 2.686×10^5 D) 2.686×10^{-5}

Evaluate the expression or indicate that the root is not a real number.

22) $\sqrt{169 - 25}$

A) 12 B) 144 C) $\sqrt{119}$ D) 17

23) $-\sqrt{361}$

A) 19 B) -180 C) -19 D) Not a real number

Use the product rule to simplify the expression.

24) $\sqrt{486x^2}$

A) $9|x|\sqrt{6}$ B) $9\sqrt{6}$ C) $9x^2\sqrt{6}$ D) $9\sqrt{6x^2}$

Use the quotient rule to simplify the expression.

25) $\dfrac{\sqrt{56x^4}}{\sqrt{2x}}$

A) $\dfrac{x^2\sqrt{56}}{2}$ B) $56x^3$ C) $2|x|\sqrt{x}$ D) $2|x|\sqrt{7x}$

Add or subtract terms whenever possible.

26) $2\sqrt{6} + 5\sqrt{6}$

A) $-3\sqrt{6}$ B) $7\sqrt{6}$ C) $7\sqrt{12}$ D) $10\sqrt{12}$

27) $3\sqrt{2x} - 8\sqrt{2x}$

A) $11\sqrt{2}$ B) $-5x\sqrt{4}$ C) $-24\sqrt{4x}$ D) $-5\sqrt{2x}$

Rationalize the denominator.

28) $\dfrac{\sqrt{49}}{\sqrt{3}}$

A) $\dfrac{49\sqrt{3}}{3}$ B) 16 C) $\dfrac{7\sqrt{3}}{3}$ D) $7\sqrt{3}$

29) $\dfrac{2}{3 - \sqrt{10}}$

A) $\dfrac{6 + 2\sqrt{10}}{7}$ B) $\dfrac{6 - 2\sqrt{10}}{-1}$ C) $\dfrac{2}{3} - \dfrac{2}{\sqrt{10}}$ D) $\dfrac{6 + 2\sqrt{10}}{-1}$

Evaluate the radical expressions or indicate that the root is not a real number.

30) $\sqrt[4]{(-5)^4}$

A) -5 B) 625 C) 5 D) not a real number

Add or subtract terms whenever possible.

31) $7\sqrt[3]{16} + \sqrt[3]{128}$

A) $7\sqrt[3]{144}$ B) $11\sqrt[3]{2}$ C) $8\sqrt[3]{144}$ D) $18\sqrt[3]{2}$

Evaluate the expression without using a calculator.

32) $81^{1/4}$

A) 12 B) 3 C) 243 D) 36

Simplify using properties of exponents.

33) $\frac{70x^{3/4}}{10x^{1/3}}$

A) $7x^{5/4}$ B) $7x^{5/12}$ C) $7x^{1/6}$ D) $60x^{1/6}$

Perform the indicated operations. Write the resulting polynomial in standard form.

34) $(8x^7 - 8x^5 - 5x) + (2x^7 - 6x^5 - 7x)$

A) $-16x^{13}$ B) $-3x^7 + 2x^5 - 15x$ C) $10x - 14x^7 - 12x^5$ D) $10x^7 - 14x^5 - 12x$

Find the product.

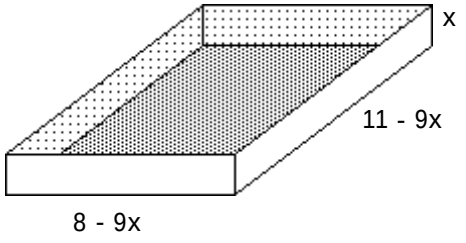
35) $(x - 12)(x^2 + 4x - 7)$

A) $x^3 - 8x^2 - 41x - 84$ B) $x^3 + 16x^2 + 55x + 84$

C) $x^3 - 8x^2 - 55x + 84$ D) $x^3 + 16x^2 + 41x - 84$

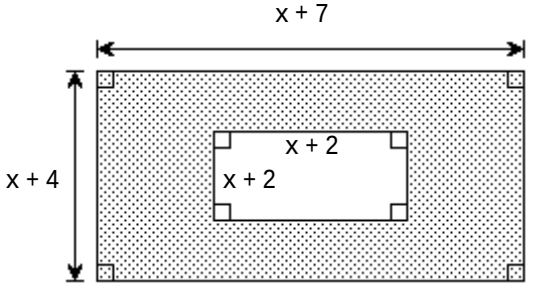
Solve the problem.

36) Write a polynomial in standard form that represents the volume of the open box.



A) $9x^3 - 171x^2 + 88x$ B) $81x^2 - 171x + 88$ C) $81x^3 - 171x^2 + 88x$ D) $81x^3 + 171x^2 + 88x$

37) Write a polynomial in standard form that represents the area of the shaded region.



A) $15x + 32$ B) $-7x - 24$ C) $7x + 24$ D) $x^2 + 24x + 24$

Factor out the greatest common factor.

38) $x(x + 8) + 9(x + 8)$

A) $(x + 8)(x + 9)$ B) $9x(x + 8)$

C) $8x(x + 9)$ D) $(x^2 + 8x) + (9x + 72)$

Factor the trinomial, or state that the trinomial is prime.

39) $x^2 + 5x - 24$

A) $(x - 8)(x + 3)$ B) $(x + 8)(x - 3)$ C) $(x - 8)(x + 1)$ D) prime

Factor by grouping. Assume any variable exponents represent whole numbers.

40) $x^3 - 4x^2 - 2x + 8$

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

Factor completely, or state that the polynomial is prime.

41) $4x^3 - 484x$

A) $x(x + 11)(4x - 44)$ B) $4x(x + 11)(x - 11)$ C) $4(x + 11)(x^2 - 11x)$ D) prime

42) $2x^2 - 16x - 18$

A) $(2x + 2)(x - 9)$ B) $2(x + 1)(x - 9)$ C) $(x + 1)(2x - 18)$ D) $2(x^2 - 8x - 9)$

Multiply or divide as indicated.

43) $\frac{5x}{10x + 5} \cdot \frac{8x + 4}{3}$

A) $\frac{x}{3}$ B) $\frac{4x}{15}$ C) $\frac{4}{3}$ D) $\frac{4x}{3}$

44) $\frac{1}{x + 6} \div \frac{3}{x^2 - 36}$

A) $\frac{3}{x - 6}$ B) $x - 6$ C) $\frac{x + 6}{3}$ D) $\frac{x - 6}{3}$

Add or subtract as indicated.

45) $\frac{4}{x + 3} - \frac{2}{x - 3}$

A) $\frac{2x - 6}{(x + 3)(x - 3)}$ B) $\frac{2}{(x + 3)(x - 3)}$ C) $\frac{2x + 18}{(x + 3)(x - 3)}$ D) $\frac{2x - 18}{(x + 3)(x - 3)}$

Simplify the complex rational expression.

46) $\frac{1 - \frac{5}{x}}{1 + \frac{5}{x}}$

A) $x + 5$ B) $\frac{x - 5}{x + 5}$ C) $x - 5$ D) $\frac{x + 5}{x - 5}$

Solve the linear equation.

47) $6x - 1 = 7(x + 9)$

A) {62} B) {64} C) {-62} D) {-64}

48) $\frac{x + 6}{2} - 1 = \frac{x - 6}{7}$

A) $\left\{-\frac{53}{5}\right\}$ B) $\{-8\}$ C) $\left\{\frac{40}{9}\right\}$ D) $\left\{-\frac{16}{5}\right\}$

Solve the formula for the specified variable.

49) $S = 2\pi rh + 2\pi r^2$ for h

A) $h = \frac{S}{2\pi r} - 1$ B) $h = \frac{S - 2\pi r^2}{2\pi r}$ C) $h = S - r$ D) $h = 2\pi(S - r)$

Solve the equation by factoring.

50) $6x^2 - 53x = 9$

A) $\left\{\frac{1}{53}, -\frac{1}{6}\right\}$ B) {-6, 9} C) $\left\{-\frac{1}{6}, 6\right\}$ D) $\left\{-\frac{1}{6}, 9\right\}$

Solve the absolute value equation or indicate that the equation has no solution.

51) $|5x + 6| = 4$

A) $\left\{-\frac{2}{5}, -2\right\}$ B) $\left\{-\frac{1}{3}, -\frac{5}{3}\right\}$ C) $\emptyset$ D) $\left\{\frac{2}{5}, 2\right\}$

Solve the equation by factoring.

52) $6x^2 + 19x + 15 = 0$

A) $\left\{\frac{5}{3}, \frac{3}{2}\right\}$ B) $\left\{-\frac{5}{3}, -\frac{3}{2}\right\}$ C) $\left\{-\frac{5}{6}, -\frac{1}{5}\right\}$ D) $\left\{\frac{5}{3}, -\frac{3}{2}\right\}$

Solve the quadratic equation by the square root property.

53) $(x - 6)^2 = 4$

A) {10} B) {-8, 4} C) {4, 8} D) {-2, 2}

Solve the radical equation, and check all proposed solutions.

54) $x - \sqrt{3x - 2} = 4$

A) {2, 9} B) {-1} C) {1, 2} D) {9}

Solve the problem.

55) A car rental agency charges $250 per week plus $0.25 per mile to rent a car. How many miles can you travel in one week for $400?

A) 350 mi B) 600 mi C) 1600 mi D) 575 mi

56) An auto repair shop charged a customer $355 to repair a car. The bill listed $55 for parts and the remainder for labor. If the cost of labor is $30 per hour, how many hours of labor did it take to repair the car?

A) 9 hr B) 10.5 hr C) 11 hr D) 10 hr

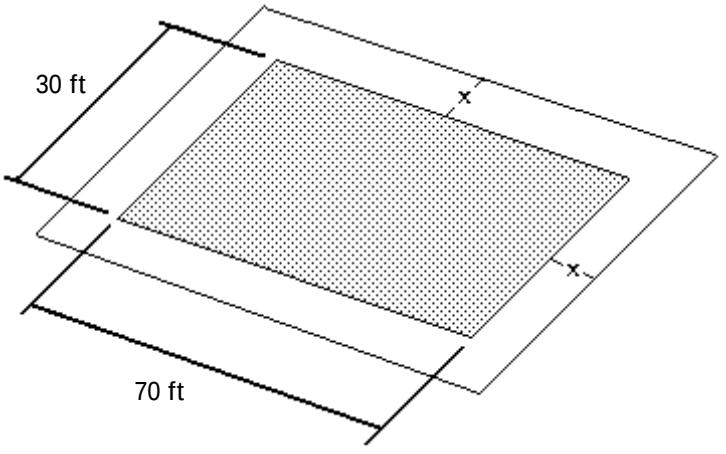
57) After a 13% price reduction, a boat sold for $21,750. What was the boat's price before the reduction? (Round to the nearest cent, if necessary.)

A) $2827.50 B) $24,577.50 C) $25,000 D) $167,307.69

58) The sum of the angles of a triangle is 180°. Find the three angles of the triangle if one angle is twice the smallest angle and the third angle is 28° greater than the smallest angle.

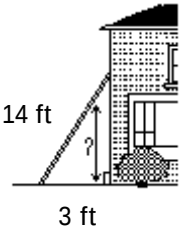
A) 24°, 52°, 104° B) 24°, 48°, 108° C) 30°, 60°, 90° D) 38°, 76°, 66°

59) The rectangular swimming pool in the figure shown measures 30 feet by 70 feet and contains a path of uniform width around the four edges. The perimeter of the rectangle formed by the pool and the surrounding path is 232 feet. Determine the width of the path.



A) 33 ft B) 8 ft C) 4 ft D) 12 ft

60) A 14-foot ladder is leaning against a house with the base of the ladder 3 feet from the house. How high up the house does the ladder reach? If necessary, round to the nearest tenth foot.



A) 14 ft B) 11 ft C) 14.3 ft D) 13.7 ft