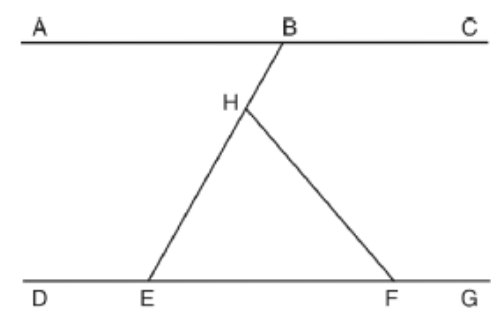**Math 3 QuizBowl**

1.

What are the coordinates of the center and length of the radius of the circle whose equation is $x^2 + 6x + y^2 - 4y = 23$?

A. $(3, -2)$ and 36　　　B. $(3, -2)$ and 6

C. $(-3, 2)$ and 36　　　D. $(-3, 2)$ and 6

2.

What is the solution set of $|x - 2| = 3x + 10$?

A. $\{\ \}$　　　　　　　B. $\{-2\}$

C. $\{-6\}$　　　　　　D. $\{-2, -6\}$

3.

Which transformation of $y = f(x)$ moves the graph 7 units to the left and 3 units down?

A. $y = f(x + 7) - 3$　　　B. $y = f(x + 7) + 3$

C. $y = f(x - 7) - 3$　　　D. $y = f(x - 7) + 3$

4.

What is the domain of the function $g(x) = 3^x - 1$?

A. $(-\infty, -3]$　　　　B. $(-\infty, 3)$

C. $(-\infty, \infty)$　　　　D. $(-1, \infty)$

5.

The terminal side of an angle measuring $\dfrac{4\pi}{5}$ radians lies in Quadrant

A. I　　　B. II　　　C. III　　　D. IV

6.

In the diagram below, $\overline{ABC} \parallel \overline{DEFG}$. Transversal $\overline{BHE}$ and line segment HF are drawn.

If $m\angle HFG = 130$ and $m\angle EHF = 70$, what is $m\angle ABE$?

A. 40　　　B. 50　　　C. 60　　　D. 70

7. What is the sum of the roots of the equation $-3x^2 + 6x - 2 = 0$?

A. $\frac{2}{3}$　　　B. 2　　　C. $-\frac{2}{3}$　　　D. -2

8. In parallelogram $CARS, m < C = 5x - 20$ and $m < A = 3x + 40$. Find the value of x.

A. 15　　　B. 20　　　C. 30　　　D. 130

9.

The amount of money in an account can be determined by the formula $A = Pe^{rt}$, where P is the initial investment, r is the annual interest rate, and t is the number of years the money was invested. What is the value of a $5000 investment after 18 years, if it was invested at 4% interest compounded continuously?

A. $9367.30　　　　　　B. $9869.39

C. $10,129.08　　　　　D. $10,272.17

10. What are the amplitude and the period of the graph represented by the equation $y = -3\cos\frac{\theta}{3}$?

A. amplitude: -3; period: $\dfrac{\pi}{3}$

B. amplitude: -3; period: 6π

C. amplitude: 3; period: $\dfrac{\pi}{3}$

D. amplitude: 3; period: 6π

11.

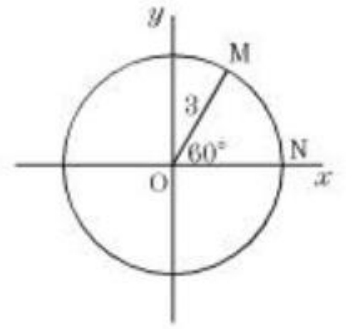In the diagram below, quadrilateral $ABCD$ is inscribed in circle P.
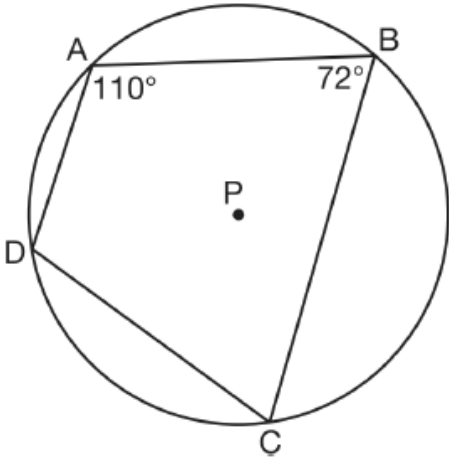
What is $m\angle ADC$?

A. $70°$ B. $72°$ C. $108°$ D. $110°$

12.

If $m\angle NOM = 60°$, then what is the length of the minor arc $\widehat{NM}$?

A. $\frac{5}{4}$ B. $\frac{5}{2}$

C. π D. 2π

13.

What is the equation of the inverse of $y = \dfrac{3}{x+2}$?

A. $y = \dfrac{3}{x} - 2$

B. $y = \dfrac{1}{3}x + \dfrac{2}{3}$

C. $y = -\dfrac{3}{x+2}$

D. $y = -\dfrac{3}{x} - \dfrac{3}{2}$

14.

When $-3 - 2i$ is multiplied by its conjugate, the result is

A. -13 B. -5 C. 5 D. 13

15.

What is the solution set of the equation $\dfrac{30}{x^2 - 9} + 1 = \dfrac{5}{x - 3}$?

A. $\{2, 3\}$ B. $\{2\}$ C. $\{3\}$ D. $\{\ \}$

16. Which of the following statements is true of $f(x) = -x^3 - 6x^2 - 9x - 2$?

a. f(x) is decreasing on (-3, -1)
b. f(x) is increasing on (-3, -1)
c. f(x) is increasing on (-∞, -3)
d. f(x) is increasing on (-2, 2)

17. In ΔABC, centroid D is on median $\overline{AM}$. AD = x + 3 and DM = 3x − 6. Find AM.

a. 4 ½   b. 10   c. 3   d. 9

18.

Consider the piecewise defined function

$$f(x) = \begin{cases} \sqrt{-x} & \text{if } x < 1, \\ x + 1 & \text{if } x \geq 1. \end{cases}$$

Evaluate $f(-1) + f(1)$.

(a) undefined   (b) 1   (c) 2   (d) 3   (e) $\sqrt{2}$

19.

$|6 - x| \geq 2$. Find all values of x which make this equation true.

a. $\{x \mid x \leq 4 \ or \ x \geq 8\}$
b. $\{x \mid x \leq -4 \ or \ x \geq 4\}$
c. $\{x \mid x \leq -8 \ or \ x \geq 8\}$
d. $\{x \mid x \leq -8 \ or \ x \geq -4\}$

20. A mug of hot chocolate measures 8.6 cm in diameter and has a height of 11.2 cm. The top 0.4 cm of the mug is filled with froth; the rest is hot chocolate. Rounding to the nearest cubic centimeter, how much hot chocolate is in the mug?

a. 146 cm³   b. 292 cm³   c. 627 cm³   d. 2508 cm³

21.

Find the height of the tree to the nearest foot.

29.7°

20ft
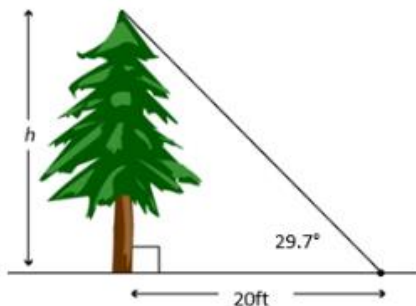
a. 136.1 ft   b. 11 ft   c. 14.7 ft   d. 594 ft

22. For the equation $2x^4 - 5x^3 + 10 = 0$, find the number of complex roots and the possible number of real roots.

a.   4 complex roots; 0, 2 or 4 real roots

b.   4 complex roots; 1 or 3 real roots

c.   3 complex roots; 1 or 3 real roots

d.   3 complex roots; 0, 2 or 4 real roots

23.

Which of the following is true?

(A) $x^3 - 8 = (x - 2)^2$
(B) $x^3 + 8 = (x + 2)^3$
(C) $x^3 - 8 = (x^2 + 4)(x - 2)$
(D) $x^3 + 8 = (x + 2)(x^2 - 2x + 4)$
(E) $x^3 - 8 = (x - 2)(x^2 + 4x + 4)$

24. A researcher designed a study to determine whether fatigue has an impact on the effectiveness of physical workouts. She plans to monitor the number of calories burned for each participant's workouts over a period of time. Sometimes participants will be asked to stay up late the night prior to their workouts. At other times participants will be asked to get a good night's sleep before working out. Which of the following has the researcher designed?

a. an observational study   c. an experiment
b. a survey   d. none of the above

25. The following table reflects the contents of a package of hard candy:

Flavor	Lemon	Apple	Orange	Mango	Cherry	Peach	Lime
Number of candies	15	9	14	22	8	5	18

What is the estimated population proportion of the most common flavor?

a. 0.24   c. 0.05
b. 0.16   d. 0.20

**26.** Kathleen rotated an isosceles trapezoid 360° around its longest base. Which choice could be the resulting solid?

A.   B.   C.   D.
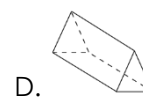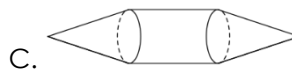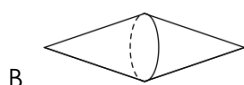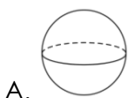
27. A circle has a radius of 4 inches. A central angle forms an arc with a length of $\frac{4\pi}{3}$ inches. Which ratio models the measure of this central angle in radians?

A. π:6   B. π:3   C. 2π:3   D. 4π:3

28. John wrote a proof for the congruency of the opposite sides of a parallelogram as shown below.
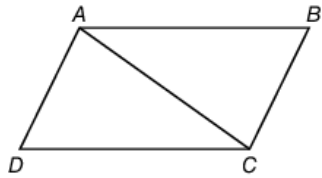
Statements	Reasons
1. $\overline{AB} \parallel \overline{CD}$	1. Given
2. $\overline{AD} \parallel \overline{BC}$	2. Given
3. $\angle BAC \cong \angle DCA$	3. Alternate interior angles
4. $\angle DAC \cong \angle BCA$	4. Alternate interior angles
5. $\overline{AC} \cong \overline{AC}$	5. Reflexive Property
6. $\triangle ABC \cong \triangle CDA$	6. AAS
7. $\overline{AB} \cong \overline{CD}$	7. CPCTC
8. $\overline{AD} \cong \overline{BC}$	8. CPCTC

Which of these is **correct**?

A. The proof is correct as is.

B. The postulate that proves the congruency of the triangles should be ASA instead of AAS.

C. The reason for the congruency of the angles $\angle BAC \cong \angle DCA$ and $\angle BCA \cong \angle DAC$ should be vertical angles instead of alternate interior angles.

D. The reason for the congruency of the angles $\angle BAC \cong \angle DCA$ and $\angle BCA \cong \angle DAC$ should be corresponding angles instead of alternate interior angles.

29. A student is curious about the average age of a penny in circulation. The student collects pennies for a few months and places them in a jar. Once the jar is full, the student mixes up the pennies, randomly selects 100 of them, records the age of each penny selected, and finds the average age. Which of the following best describes the way the average age of a penny in circulation was determined?

A. This is a sample survey.

B. This is an observational study.

C. This is an experiment that used a controlled group.

D. This is an experiment that did not use randomization.

30. The owners of a manufacturing company conducted a survey to determine the mean income of the customers who prefer the company's brand of clothing. From a random sample of 100 customers, it was determined that their mean income was $47,600. Which conclusion can be made based on this information?

A.   The total population mean must be much greater than $47,600 because there are more people in the total population.

B.   The total population mean must be close to $47,600 based on statistical inference.

C.   The total population mean must be much less than $47,600 because, out of a sample of 100, a few people with a very high mean income would skew the data.

D.   The total population mean cannot be determined by such a small random sample.

31. What is the value of t in the equation $0.65 = 0.5 \times 10^{-0.014t}$?

A. $\dfrac{\log 0.325}{0.014}$

B. $\dfrac{\log 1.3}{-0.014}$

C. $\dfrac{\log 1.3}{0.014}$

D. $\dfrac{\log 0.325}{-0.014}$

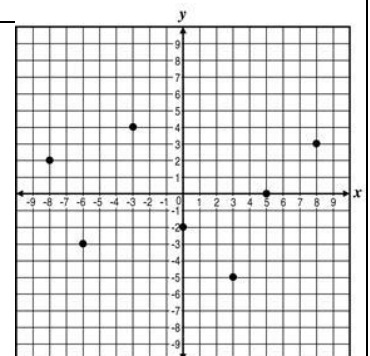32. The graph of the function $f(x)$ is shown on the coordinate plane.

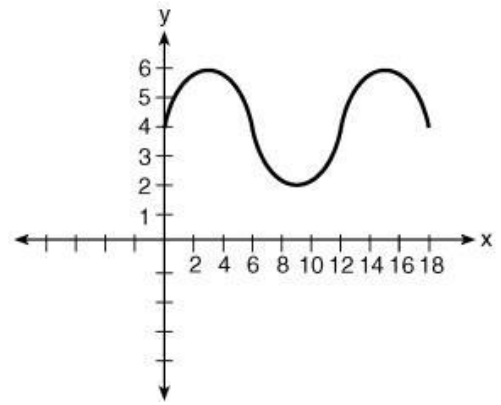Which value is closest to $f^{-1}(-3)$?

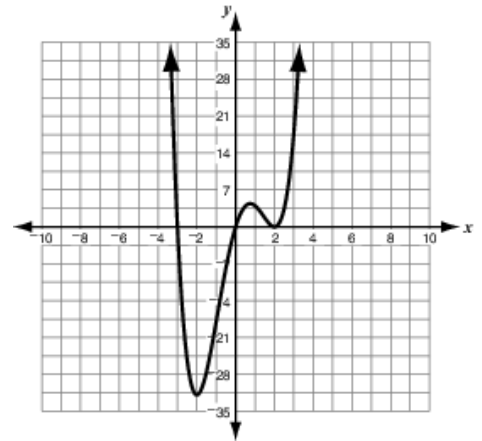A. -6 B. -5

C. 4   D. 8

33. What is the amplitude of the function shown in the accompanying graph?

A. 1.5

B. 2

C. 4

D. 12

34. Which function **best** represents the graph below?

A. $g(x) = x(x-2)^2(x+3)$

B. $g(x) = (x-2)^2(x+3)$

C. $g(x) = x(x-2)(x+3)$

D. $g(x) = (x-2)(x+3)$

35. One solution of a quadratic equation with real coefficients is x = 3 + 4i, where $i = \sqrt{-1}$. What is the sum of the solutions of the quadratic equation?

A. 0   B. 6   C. 8i   D. 6 + 8i

36. Given the function $P(x) = x^3 + 4x^2 + kx + 15$, for what value of k is $(x+3)$ a factor of $P(x)$?

A. −26   B. −8   C. 8   D. 26

37. Given that $p(-3) = 0, p(-1) = 0,$ and $p(5) = 0,$ which expression could be $p(x)$?

A. $x^3 - x^2 - 17x - 15$ B. $x^3 + x^2 - 17x + 15$ C. $x^3 - 3x^2 - 13x + 15$ D. $x^3 - 9x^2 + 23x - 15$

38. Which expression is equivalent to $\dfrac{x+7}{x^2+4x-21} \div \dfrac{x+5}{x^2+8x+15}$ when x is restricted so that the expressions are defined?

A. $\dfrac{x+3}{x-3}$ B. $\dfrac{x-3}{x+3}$ C. 1   D. -1

39. Which function has an asymptote at y = 1?

A. $y = x + 1$

B. $y = \dfrac{x}{x+1}$

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

D. $y = x(x+1)$
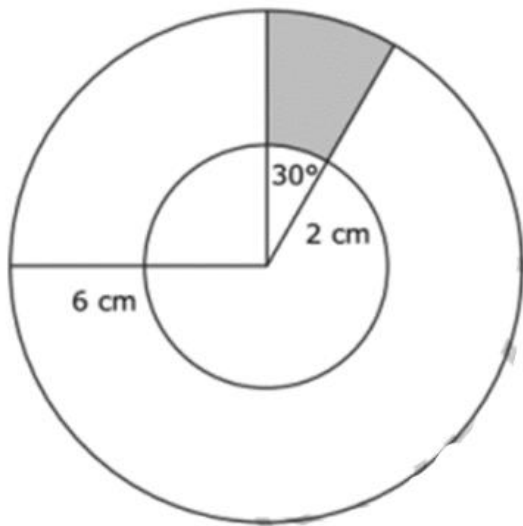
40. A system of equations is shown below.

$$y = |x - 3|$$
$$y = \tfrac{1}{2}x$$

What is the distance between the points of intersection of the system?

A $\sqrt{6}$

B $\sqrt{20}$

C $\sqrt{48}$

D $\sqrt{80}$

41. In the figure below, the larger circle has a radius of 6 cm, and the smaller circle has a radius of 2 cm.

What is the **approximate** area of the shaded region?

A   2.1 cm²

B   3.4 cm²

C   4.2 cm²

D   8.4 cm²

42. William put the tip of his pencil on the outer edge of a graph of the unit circle at the point (0, ⁻1). He moved his pencil tip through an angle of $\frac{4\pi}{3}$ radians in the counterclockwise direction along the edge of the circle. At what angle of the unit circle did William's pencil tip stop?

A $\frac{\pi}{3}$

B $\frac{5\pi}{6}$

C $\frac{7\pi}{6}$

D $\frac{5\pi}{3}$

43. The volume of a rectangular prism is represented by the expression $(x^3 - 2x^2 - 20x - 24)$. If the length is $(x - 6)$ and the height and width are equal, what is the width of the prism?

A $x + 2$

B $x - 2$

C $x + 4$

D $x - 4$

44. The equation $2x^2 - 5x = ⁻12$ is rewritten in the form of $2(x - p)^2 + q = 0$. What is the value of q?

A $\frac{167}{16}$

B $\frac{71}{8}$

C $\frac{25}{8}$

D $\frac{25}{16}$

45. Which function goes to positive ∞ most quickly as x increases?

A $y = \log(x) + 100$

B $y = e^{x-9} - 3$

C $y = x^2 + 5x + 6$

D $y = 3x^5 + 4x^3 - 11x - 6$