Passport to Advanced Math Overview

Operations with Polynomials

1. In the equation below, g is a constant. If the equation is true for all possible values of x, what is the value of g?

$$x^4 - x^2 + 2g(x + 7) = g(x^2 + x)(x^2 - x) + 14\left(g + \frac{gx}{7}\right)$$

   A) 1
   B) 2
   C) All real numbers
   D) No solution

2. Which of the following polynomials is equivalent to $(5yz + 5y^2)(z^2 - zy + y^2)$?

   A) $5y(z^3 + y^3)$
   B) $5(y^3 + z^3)$
   C) $5yz^3 + 10y^2z^2 + 20y^3 + 5y^4$
   D) $5z^3 + 5y^4$

3. What is the sum of the solutions of $(x^2 + 2x + 1) = (2x + 3)^2$?

Quadratic & Exponential Word Problems

4. Shannon is knitting a quilt for her teacher. The quilt is made up of 120 different patches. If Shannon knits at a rate of r patches per hour for 5 hours and then knits at a rate of $\frac{r}{2}$ patches per hour for $\frac{r}{4}$ hours until she has finished the quilt, which of the following equations can be used to find the value of r?

   A) $\frac{r}{8} + 5r^2 + 120 = 0$
   B) $\frac{r^2}{8} + 5r - 120 = 0$
   C) $\frac{5r}{8} - 120 = 0$
   D) $\frac{5r^2}{8} - 120 = 0$

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5. A mushroom farmer is growing a particularly tall mushroom. If the height of the mushroom when it was first planted was 15 centimeters, and the mushroom grows at a monthly rate of 1.5%, which of the following equations appropriately models the height h of the mushroom m months from when it was planted?

      A) $h = 15 + (1 + 0.015)^m$
      B) $h = 15m^{(1+0.015)}$
      C) $h = 15(1 + 0.015)^m$
      D) $h = 15m + 0.015$

Solving Quadratic Equations

6. What are the solutions y to $4y^2 - 2y = 5$?

      A) $\dfrac{1 \pm \sqrt{6}}{4}$
      B) $\dfrac{1 \pm \sqrt{21}}{4}$
      C) $\dfrac{1 \pm \sqrt{21}}{8}$
      D) $\dfrac{2 \pm \sqrt{21}}{4}$

7. If $c < 0$ and $3c^2 - 13c - 10 = 0$, what is the value of c?

      Radicals & Rational Exponents

8. Which of the following expressions is equivalent to $x^{-\frac{7a}{2}}$?

      A) $\dfrac{1}{\sqrt{x^{7a}}}$
      B) $-\dfrac{7}{\sqrt{x^a}}$
      C) $\dfrac{7}{\sqrt{x^a}}$
      D) $\dfrac{7ax}{2}$

Radical and Rational Equations

9. What are the solutions a to the equation below?

$$2a - 3 = \sqrt{-8a + 33}$$

A) -2
B) 3
C) -2 and 3
D) No real solutions

10. What is the solution(s) x to the equation below?

$$\frac{1}{x+1} + \frac{2}{4x} = \frac{8}{x^2 + x}$$

Linear & Quadratic Systems

11. What are the solutions (x, y) to the equation below?

$$(x + y)^2 - 2x(-5 + y) = 9$$
$$x + 3 - y = 0$$

Polynomial Factors & Graphs

12. If the polynomial below has factors $(a + 3)$, $(a + 4)$ and $(a + c)$, what is the value of constant c?
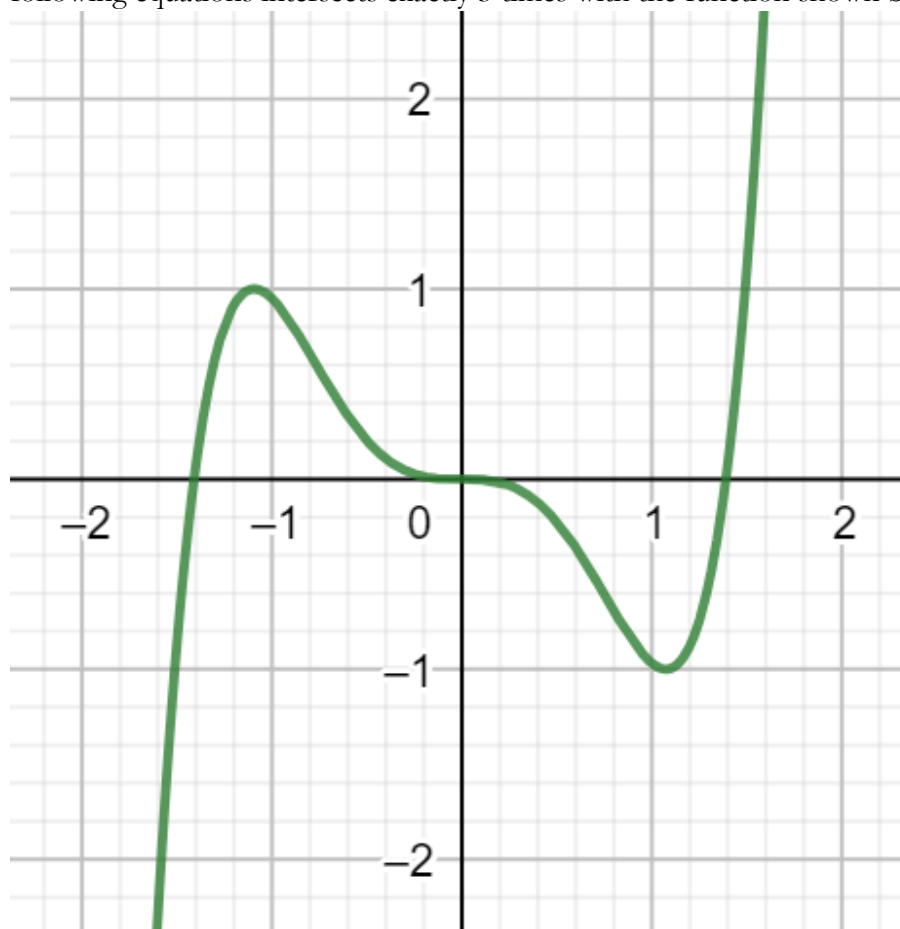
$$a^3 + 12a^2 + 47a + 60$$

13. The graph of which of the following in the xy plane has only one x-intercept?

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

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Nonlinear Equation Graphs

14. The equation $y = x^5 - 1.96x^3$ is graphed in the xy coordinate plane below. Which of the following equations intersects exactly 3 times with the function shown below?

A) $y = -1$
B) $y = 1$
C) $y = x$
D) $y = x^2 + 2$

Function Notation

15. If $f(a) = x^2 + 1$ and $g(a) = 3a - 5$, what is the value of $f(g(5))$?

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Interpreting non-linear expressions

16. For a certain pencil sharpener, the function $s(x)$ gives the number of shavings a pencil releases if it is turned x times in the sharpener. What does the equation $s(b) = c$ mean in context?

        A) If a pencil is turned b times, then it releases c shavings.
        B) If a pencil is turned c times, then it releases b shavings.
        C) If a pencil is turned c times, then it releases bc shavings.
        D) If a pencil is turned x times, then it releases c shavings.

17. The radial acceleration α of an object swinging in a circle can be given by the equation $\alpha = \frac{v^2}{r}$, where v is the linear velocity of the object and r is the radius of the circle the object is swung in. If the radial acceleration of an object is quadrupled, which of the following could represent the change in v and r?

        A) Only r is doubled
        B) Both v and r are doubled
        C) Only v is doubled
        D) Only v is doubled, and r is halved.

Isolating Quantities

18. Kepler's third law of planetary motion states that $\left(\frac{T_1}{T_2}\right)^2 = \left(\frac{r_1}{r_2}\right)^3$, where T_1 is the period of one satellite and T_2 is the period of another, and r_1 is the semi-major axis of one satellite and r_2 that of another. Which of the following equations gives T_1 in the terms of T_2, r_1, and r_2?

    A) $T_1 = \left(\frac{r_1}{r_2}\right)^3 + T_2$

    B) $T_1 = \left(\frac{r_1}{r_2}\right)^3 * T_2$

    C) $T_1 = \left(\frac{r_1}{r_2}\right)^{\frac{3}{2}} + T_2$

    D) $T_1 = \left(\frac{r_1}{r_2}\right)^{\frac{3}{2}} * T_2$

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Manipulating Quadratic & Exponential Functions

19. A baker estimates that if a load of bread dough is left to rise for h hours, the bread dough will rise to a height of $b(h) = -9h^2 + 54h$ centimeters. Which of the following equivalent forms of $b(h)$ shows both the maximum height of the bread dough and the hours it takes for the bread dough to reach that height?

   A) $b(h) = -9(h^2 - 6)$
   B) $b(h) = -9(h^2 + 6)$
   C) $b(h) = -(3h - 9)^2 - 81$
   D) $b(h) = -(3h - 9)^2 + 81$

Operations with Rational Expressions

$$\frac{7}{x-2} + \frac{9}{3(x-2)}$$

20. Which of the following expressions is equivalent to the one presented above, where $x \neq 2$?

   A) $\frac{16}{3(x-2)}$
   B) $\frac{2}{3(x-2)}$
   C) $\frac{10}{x-2}$
   D) $\frac{16}{3x-6}$

$$\frac{(\frac{a^4 b^3 c^7}{xy})}{(\frac{a^3 bc^4}{x^5 y})}$$

21. Which of the following expressions is equivalent to the one above, where $a, b, c, x, y > 0$?

   A) $ab^2 c^3 x^4$
   B) $a^7 b^4 c^{11} x^5 y^2$
   C) $\frac{ab^2 c^3}{x^4}$
   D) $abcx^4 y$

22.

$$\frac{6}{7x} * \frac{3z}{18x}$$

Which of the following expressions is equivalent to the above product, for all $x > 0$?

A) $-\frac{3z}{11x}$

B) $\frac{9z}{15x}$

C) $-\frac{11x}{z}$

D) $\frac{z}{7x^2}$

Linear and Quadratic Systems

What to know:

- Solving non-linear systems of equations with Algebra
- Solving non-linear systems of equations with Graphing
- Predicting Behavior in linear / quadratic systems by knowing vertex / direction
    - Vertex Form
    - –b/2a ($ax^2 + bx + c$ form)
    - average of the zeroes
- # Of Solutions: Patterns in Linear/Quadratic Systems (The Discriminant!)

23.

$$y = 3x^2$$
$$3y = 2(4x^2 + 5) + 3x$$

If (x, y) is a solution of the system of equations above and $x > 0$, what is the value of xy?

A) 5

B) 75

C) 150

D) 375

24. In the xy-plane, the graph of the equation $y = 5(x + 9)$ intersects the graph of the equation $y = 2x^2$ at two points. What is the sum of the x-coordinates of the two points?

A) -9

B) -2.5

C) 2.5

D) 9

25.

$$y = 5$$
$$y = ax^2 + b.$$

In the system of equations above, a and b are constants. For which of the following values of a and b does the system of equations have exactly two real solutions?

A) $a = -1, b = -1$
B) $a = -1, b = 3$
C) $a = 3, b = 4$
D) $a = 3, b = 6$

Answers:

1. A   2. A   3. $-\frac{10}{3}$ 4. B   5. C   6. B   7. 5   8. A   9. B   10. $x = 5$

11. $(0, 3), (-8. -5)$ 12. $c = 5$ 13. C   14. C   15. **101**   16. A

17. C   18. D   19. D   20. C   21. A   22. D   23. D   24. C   25. C

For full video explanations of all above problems, see videos in Concise Content Review: Passport to Advanced Math plus the name of the subheading.