"For all questions, answer choice "E. NOTA" means none of the above answers is correct."

1. The sum of the integers 1 through n inclusive can be modeled by a quadratic expression. What is the product of the non-zero coefficients of that polynomial?

A. 0   B. ¼   C. ½   D. 2   E. NOTA

2. What is the sum of the x-intercepts of $g(t) = e^{2t} - e^{t+ln9} + 14$

A. ln2   B. $\ln\left(\frac{2}{7}\right)$ C. ln7   D. ln14   E. NOTA

3. What is the value of $\cfrac{1}{2+\cfrac{1}{2+\cfrac{1}{2+\cdots}}}$?

A. $-1 - \sqrt{2}$ B. $\frac{1}{3}$ C. $\sqrt{2}$ D. $-1 + \sqrt{2}$ E. NOTA

4. If $f(x) = ax^2 + bx + c$ and the points $(0, 8)$ and $(1, 9)$ are on $f(x)$, what is the value of $a + b + c$?

A. 1   B. 8   C. 9   D. 17   E. NOTA

5. What is the equation of the tangent line to the function $f(x) = x^2$ at $(2,4)$?

A. $y = \frac{5}{2}x - 1$ B. $y = 3x - 2$ C. $y = \frac{7}{2}x - 3$ D. $y = 4x - 4$

E. NOTA

6. If $f(x) = ax^2 + bx + c$ and it's vertex is $(5, 6)$, what is the value of $\frac{a}{b}$?

A. -10 B. $-\frac{2}{5}$ C. $-\frac{1}{12}$ D. $\frac{1}{10}$ E. NOTA

7. If $121_b = 256$, what is the value of b?

A. 12   B. 13   C. 14   D. 15   E. NOTA

8. If a ball is thrown straight up with an initial velocity of 24 ft./sec. from a height of 16 ft. above the ground, how long (in sec.) will it take to hit the ground (approximate the acceleration due to gravity on Earth as 32 $ft./sec.^2$)? The formula for height of projectile motion is the quadratic $y(t) = -\frac{g}{2}t^2 + v_0t + h_0$.

A. 1.25   B. $\frac{3+\sqrt{41}}{8}$ C. $\frac{3+2\sqrt{3}}{4}$ D. 2   E. NOTA

9. $f(x) = ax^2 + 2x + 1$ and $g(x) = x^2 + 6x + 2$. If $a < 0$, then for what value of a is there only one intersection point between f(x) and g(x)?

A. -4 B. -3 C. -2 D. -1 E. NOTA

10. What are the coordinates of the focus of $f(x) = 4x^2 + 16x + 17$?

A. $(-2, 0)$ B. $(-2, \frac{17}{16})$ C. $(2, 0)$ D. $(2, \frac{15}{16})$ E. NOTA

11. What is the sum of the zeroes of $f(x) = (1 + \sqrt{3})x^2 + 528\pi x + e^3$

A. $\pi(264 - 264\sqrt{3})$ B. $\pi(132 - 132\sqrt{3})$ C. $\pi(132\sqrt{3} + 132)$
D. $\pi(264\sqrt{3} + 264)$ E. NOTA

12. If a right triangle has an area of 17, and one leg that is twice the length of the other, what is the length of the longer leg?

A. $\frac{\sqrt{34}}{2}$ B. $\sqrt{17}$ C. $\sqrt{34}$ D. $2\sqrt{17}$ E. NOTA

13. Find the product of all solutions of $\sqrt{x^2 + 3x - 40} + \sqrt{2x^2 + 7x - 52} = 0$

A. -92 B. -24 C. 24   D. There are no solutions   E. NOTA

14. A farmer wishes to construct a rectangular fenced area alongside a linear river of width w and length l. If he needs no fence on the side with the river (i.e. only needs fence along three sides) and has 100 ft. of fence to work with and wants to enclose the largest area he can, what is the value of $w + l$?

A. 50   B. $\frac{200}{3}$ C. 70   D. 75   E. NOTA

15. If the line $y = 2$ intersects a parabola at two points at a distance of 2 units apart and one of those points is (2, 2), what is the product of the two possible x-coordinates for the vertex of the parabola?

A. -2 B. 0   C. 2   D. 4   E. NOTA

16. If $0 \le t \le 2\pi$ what is the sum of all possible values of t (in radians) that satisfy the following equation: $4\sin^2 t - 3 = 0$

A. 0   B. π C. 2π D. 4π E. NOTA

17. $f(x) = ax^2 + bx + 3$ and has exactly one zero at $x = \frac{1}{2}$. If $a \neq 0$, find ab.

A. -144 B. $-\frac{9}{4}$ C. $\frac{9}{4}$ D. 144   E. NOTA

18. Which of the following best describes the conditions under which the statement $(a + b)^2 = a^2 + b^2$ must be true?

A. $a = 0$ B. $b = 0$ C. It is always true   D. Either choice A or B   E. NOTA

19. $f(x) = a(x - h)^2 + k$ contains the points $(1, 0), (2, 2), (3, 8), (4, 18), and\ (5, 32)$. Find the value of $(a - h)k$.

A. -1 B. 0   C. 1   D. 3   E. NOTA

20. Which of the following is NOT a Pythagorean triple?

A. 13-84-85   B. 23-264-265   C. 31-480-481   D. 41-840-841   E. NOTA

21. Which of the following is the correct geometric definition of a parabola?

A. The set of all points equidistant from a given point
B. The set of all points equidistant from two given points
C. The set of all points equidistant from a given point and a line
D. The set of all points the sum of whose distances from two given points is constant
E. NOTA

22. Let $f(x) = ax^2$ and $f^n(x)$ denote n compositions of f with itself, such that $f^2(x) = f(f(x))$, $f^3(x) = f(f(f(x)))$, and so on. Find $f^9(x)$

A. $a^9 x^{18}$ B. $a^9 x^{512}$ C. $a^{511} x^{18}$ D. $a^{511} x^{512}$ E. NOTA

23. If a parabola has a vertex at $(3, 5)$ and a focus at $(3, 3)$ what is the equation of the parabola?

A. $y = -8(x - 3)^2 + 5$ B. $y = -2(x - 3)^2 + 5$ C. $y = -\frac{1}{2}(x - 3)^2 + 5$
D. $y = -\frac{1}{8}(x - 3)^2 + 5$ E. NOTA

24. If sphere A has 64 times the surface of sphere B, how many times larger is the radius of sphere A than that of sphere B?

A. 4   B. 8   C. 64   D. 4096   E. NOTA

25. What is the sum of the y-coordinates of the intersection points of $y = f(x) = 2x^2 - 5x + 8$ and $= g(x) = 3x^2 - 7x - 72$?

A. 96   B. 158   C. 254   D. 334   E. NOTA

26. $(a - 2b + 3c - 4d)^2 - (4d - 3c + 2b - a)^2 = ?$

A. 0   B. $2(a - 2b + 3c - 4d)$ C. $2(a + 2b + 3c + 4d)$ D. $2(a - 2b + 3c - 4d)^2$
E. NOTA

27. Which of the following can be factored as a "difference of two square numbers"?

A. $2016g + 25g^2 + 1$
B. $2015^2 - g^2$
C. $201,600^2 + 100g$
D. $201,600^2 + 20,160g$
E. NOTA

28. If $f(x) = (x + 1)^2$ and $f(a + b) = 2016$ and $f(a - b) = 1620$ what is $ab + b$?

A. 99   B. 198   C. 396   D. 909   E. NOTA

29. Give the equation of the line that intersects the following parabola at its vertex and y-intercept: $f(x) = 3x^2 - 12x + 8$

A. $y = -13x + 8$ B. $y = -12x + 8$ C. $y = -6x + 8$ D. $y = -2x + 8$
E. NOTA

30. In terms of p, the distance from the focus to the vertex, what is the area of the isosceles triangle which has the *latus rectum* as the base and the vertex of the parabola as the opposite vertex of the triangle?

A. $\frac{1}{2}p$ B. $\frac{1}{2}p^2$ C. p^2 D. $2p^2$ E. NOTA