Hard Problems with Desmos)

August 14, 2025

1 A township has an area of 36 square miles. If the township is exactly a square, what is the length, in yards, of the side of this square? (1 mile = 1760 yards) A. 7040 B. 10560 *** C. 15840 D. 63360

2 The point $(-5,1)$ in the xy-plane is a solution to which of the following systems of inequalities? A. $x>0$, $y>0$ B. $x>0$, $y<0$ C. $x<0$, $y>0$ *** D. $x<0$, $y<0$

3

$$\left|\frac{8-x}{6}\right|+11\left|\frac{8-x}{6}\right|=60$$

What is the positive solution to the given equation? The correct answer is 38

Question 4 Poll Results

Candidate	Votes
Ken Lee	576
Terry Bruce	481
Total	1057

The table shows the results of a poll. A total of 1057 voters selected at random were asked which candidate they would vote for in the mayor election. According to the poll, if 7399 people vote in the election, by how many votes would Ken Lee be expected to win? A. 95 B. 665 *** C. 4032 D. 6918

Question 5 If cube A has a side length of a and cube B has a side length of b, the longest diagonal of cube A is how many times the longest diagonal of cube B ? A. $\left(\frac{a}{b}\right)^3$ B. $\left(\frac{a}{b}\right)^2$ C. $\sqrt{3}$ D. $\frac{a}{b}$ ***

Question 6 If $\frac{x}{2}=\frac{y}{3}$ and $\frac{x}{y}=\frac{a}{b}$, where a and b are positive integers, what is the least value of b? 3***

Question 7

$$2x^4(3x-8)(3x+k)=0$$

In the given equation, k is a constant. The sum of all solutions is $\frac{2}{3}$. What is the value of k ? 6***

Question 8 In order to encourage tourists to purchase more items, a souvenir shop decides to give an additional 15% discount for every more item of the same kind a tourist buys. If one tourist bought 3 necklaces that are priced at x dollars each and another tourist bought 2 hats that are priced at y dollars each, which of the following expressions gives the sales from the two shoppers? A. $3x+2y$ B. $x+2\times0.85x+y+0.85y$ C. $\left(1+0.85+0.85^2\right)x+(1+0.85)y$ *** D. $3\times0.85y+2\times0.85y$

Question 9 In the xy-plane, a line passes through two points $(h,1)$ and $(k,1)$, where h and k are constants. Which of the following is true about the equation of this line? A. $x=1$ represents the line. B. The equation cannot be determined. C. $\frac{y-1}{x-1}=\frac{h-1}{k-1}$ D. $y=1$ ***

10

$$7x-8y=8y+3$$

$$py=5+14x$$

In the given system of equations, p is a constant. If the system has no solution, what is the value of p ? 32***

Question 11

Note: Figure not drawn to scale In the figure shown, triangles ACB,ADC, and CDB are all right triangles. The length of side AD is 1 . The length of side AC is 2. What is the value of $\tan B$? A. $\frac{1}{2}$ B. $\sqrt{3}$ C. $\frac{\sqrt{3}}{3}$ *** D. $\frac{\sqrt{3}}{2}$

Question 12 If the length of a diagonal of square $ABCD$ is $3\sqrt{2}$ and the length of a diagonal of square $EFGH$ is $4\sqrt{2}$, which of the following statements is NOT true? A. The ratio of the side of

square $ABCD$ to the side of square $EFGH$ is $\frac{3}{4}$ B.The ratio of the perimeter of square $ABCD$ to the perimeter of square $EFCH$ equals $\frac{9}{16}$ *** C. The ratio of the area of square $ABCD$ to the area of square $EFGH$ is $\frac{9}{16}$ D. The length of a side of square $EFGH$ is 4

Question 13 For the exponential function f, the value of $f(2)$ is c, where c is a constant. Which of the following equations of the function f shows the value of c as the coefficient or the base? A. $f(x) = 40(0.95)^{x-2}$ *** B. $f(x) = 60(0.95)^{x-1}$ C. $f(x) = 180(0.95)^{x}$ D. $f(x) = 256(0.95)^{x+1}$

Question 14

$$28 = x(112 - px)$$

In the given equation, p is an integer constant. If the equation has no real solution, what is the least possible value of p ? 113***

Question 15 Function f is defined by $f(x) = \frac{2x-1}{x+1}$ and is equivalent to $f(x) = \frac{a}{b(x-c)} + d$, where a, b, c, and d are constants, what is the value of d ? 2***

Question 16

$$y = -3.8$$

$$y = x^2 + 10x + c$$

In the given system of equations, c is a positive constant. The system has exactly one real solution. What is the value of c ? 21.2***

Question 17 The function f is defined by $f(x) = \frac{|x|}{a} - 15$, where a is a constant. What is the greatest possible value of the product of $f(25a)$ and $f(5a)$ 800***

Question 18 In the equation $ax + by = c, a, b$, and c are constants and $a < b < c < 0$. The equation represents a line in the xy-plane. Which of the following statements is true? A. The line has a positive slope. B. The line intersects the negative part of the y-axis. C. The line intersects the positive part of the x-axis. *** D. The line is parallel to line $y = -x$.

Question 19

$$(x-1)^2 + (y+2)^2 = 4$$

$$x^2 + (y-k)^2 = 9$$

The given equations represent two circles in the xy-plane. The two circles are tangent to each other. What is one value of k ? A. 2 B. 5 C. $2(\sqrt{6}-1)$ *** D. $\sqrt{6}$

Question 20

$$3x + 5y = 2$$

$$mx + ny = 2$$

In the given system of equations, $\boldsymbol{m}$ and $\boldsymbol{n}$ are constants. The graphs of the equations in the $\boldsymbol{xy}$-plane are perpendicular lines. Which of the following systems of equations also represents a pair of perpendicular lines in the xy-plane? A.

$$3x + 10y = 2$$

$$mx - ny = 2$$

B.

$$6x + 5y = 2$$

$$mx + ny = 2$$

C. ***

$$3z+10y=2$$

$$2max+ny=2$$

D.

$$6x+5y=2$$

$$mx-2ny=2$$

Question 21 Function g is defined by $g(x)=ax^2-bx+c$, where a,b, and c are constants. $g(x)$ has a vertex $(-3,5)$ in the xy-plane and has two x intercepts. Which could be the value of $a+b+c$? A. 4 *** B. 6 C. 8 D. 16

Question 22 There are two similar cylinders A and B. The volume of Cylinder A is $2,304\pi$ cm^3. The volume of You did not answer this question. Cylinder B is 36π cm^3. The radius of the base of Cylinder A is 10 cm . The surface area of Cylinder A is $k\pi$ cm^2. The surface area of Cylinder B is $n\pi$ cm^2. What is the value of $k-n$? 619.5***