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1. A line segment has endpoints $(-1,6)$ and $(2,-3)$. Find the equation of the perpendicular bisector of the line segment, and find an equation of the line that is parallel to the line $4x+3y=17$ and passes through the point $(4,-2)$. Then add together the slopes and *y* intercepts of the two equations. The sum is

A. $\frac{-31}{12}$

B. 2

C. $\frac{-4}{3}$

D. $\frac{11}{3}$

E. 6

2. Maria, Ned and Orlando each took a 6 question true-false exam. Their answers to the six questions, in order, were Maria: FFTTTT; Ned: TFFTTT, and Orlando: TTFFTT. Maria and Ned each got 5 right. What was Orlando's score?

A. 2

B. 3

C. 4

D. 5

E. 6

3. The two shortest sides of a right triangle have lengths 2 and $\sqrt{5}$. Suppose α is the smallest angle of the triangle. What is $\cos(\alpha)$?

A. $\frac{\sqrt{5}}{3}$

B. $\frac{\sqrt{5}}{2}$

C. $\frac{2}{3}$

(answer choices continue on next page)

D. $\frac{3\sqrt{5}}{5}$

E. $\frac{2\sqrt{5}}{5}$

4. Simplify $\sqrt{3+2\sqrt{2}}-\sqrt{3-2\sqrt{2}}$.

A. $\sqrt{5}$

B. 2

C. 4

D. $4\sqrt{2}$

E. 16

5. Seven red socks and four white socks are in a bag. Two socks are drawn at random without replacement. What is the probability that the two socks are the same color?

A. $\frac{27}{110}$

B. $\frac{504}{3025}$

C. $\frac{27}{55}$

D. $\frac{28}{121}$

E. $\frac{1}{2}$

6. Suppose $a_n = a_{n-1} + a_{n-2} + a_{n-3}$ for $n \geq 4$. If $a_4 = 20$, $a_5 = 36$, and $a_7 = 121$, what is the value of a_1?

A. 6

B. 9

C. 7

D. 8

E. 4

7. Two students attempted to solve a quadratic equation of the form $x^2 + bx + c = 0$. Although both students did the work correctly, one miscopied the middle term and obtained the solution set $\{2, 3\}$, while the other miscopied the constant term and obtained the solution set $\{2, 5\}$. What is the correct solution set?

A. $\{-1, -6\}$

B. $\{3, 5\}$

C. $\{-2, 8\}$

D. $\{1, 6\}$

E. $\{-2, 5\}$

8. Find the sum of the frequency, period and amplitude of the function $f(x) = 5 - 2\sin(5\pi x + 2)$.

A. 4.9

B. 2.8

C. 10

D. 14

E. 0.9

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9. Simplify: $\dfrac{\csc(\theta)}{\sin^2(\theta)+\sec(\theta)+\cos^2(\theta)-1}$, if $\sin(\theta), \cos(\theta) \neq 0$.

A. $\sec(\theta)\csc(\theta)$

B. $\csc^2(\theta)$

C. $\cot(\theta)$

D. $\tan(\theta)$

E. $\cot^2(\theta)$

10. Solve for x: $7^{5x+4} = 6^{3x-5}$

A. $\dfrac{\ln 7}{\ln 6}$

B. $\dfrac{\ln 6}{\ln 7}$

C. $\dfrac{4\ln 7 + 5\ln 6}{5\ln 7 - 3\ln 6}$

D. $\dfrac{4\ln 7 + 5\ln 6}{3\ln 6 - 5\ln 7}$

E. $\dfrac{3\ln 6 - 5\ln 7}{4\ln 7 + 5\ln 6}$

11. For how many positive integers less than 100 is $(x-5)(x-23)(x-68)$ positive?

A. 48

B. 50

C. 46

D. 52

E. 44

12. The first term of an infinite geometric series is 26. If the sum of the series is 65, what is the common ratio?

A. $\frac{5}{8}$

B. $\frac{2}{13}$

C. $\frac{3}{5}$

D. $\frac{2}{5}$

E. $\frac{5}{13}$

13. In the complex plane, find the distance between $4+3i$ and $-2-5i$.

A. 10

B. $\sqrt{94}$

C. 13

D. $\sqrt{145}$

E. 15

14. There are two values of *c* for which $cx^2+(c-3)x+1=0$ has two equal roots. If these two values are *A* and *B*, where $A<B$, what is $B-A$?

A. 0

B. 8

C. 1

D. 3

E. 5

15. There are 100 students enrolled in online classes through a community college. Of these 100 students, 44 are not taking English composition online and 53 are taking History online. If 17 are taking both classes online, how many students are taking only English composition online?

A. 8

B. 27

C. 39

D. 41

E. 57

16. Find the area enclosed by the graph of $\frac{|x|}{5}-\frac{|y|}{3}=1$.

A. 60

B. 15

C. $\sqrt{34}$

D. 30

E. 45

17. Suppose $f(x)=2^x$. For which value of x is $f(x-2)=f(x)-2$?

A. $\sqrt{2}$

B. $3-\log_2 3$

C. $\log_2 3$

D. $\frac{8}{3}$

E. $2-\log_2 3$

18. How many integers between 199 and 301 are divisible by 4 or 10?

A. 26

B. 39

C. 25

D. 37

E. 31

19. If $\frac{x+2y}{2x+y}=3$, what is the value of $\frac{x+4y}{4x+y}$?

A. 18

B. 19

C. 20

D. 21

E. 6

20. Suppose $\cos(x)=\frac{-2}{7}$ where $\pi \le x \le 2\pi$. Find $\sin(2x)+\cos(2x)$.

A. $\frac{12\sqrt{5}-41}{49}$

B. $\frac{12\sqrt{5}+41}{49}$

C. $\frac{12\sqrt{5}}{49}+1$

D. $\frac{-12\sqrt{5}+41}{7}$

E. $\frac{12\sqrt{5}+41}{7}$

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21. Suppose $y = -\sqrt{3}\sec\left(2\pi x - \frac{\pi}{2}\right) + 2$. Find the sum of the zeros of the function on the interval $\left[\frac{1}{4}, \frac{5}{4}\right]$.

A. $\frac{2}{3}$

B. 1

C. $\frac{5}{4}$

D. $\frac{3}{2}$

E. $\frac{7}{6}$

22. In how many points do the conic sections $\frac{(x-2)^2}{9} - \frac{(y+3)^2}{16} = 1$ and $\frac{1}{3}y - 1 = x^2 - 4x + 4$ intersect?

A. 0

B. 1

C. 2

D. 3

E. 4

23. Find the inverse of this matrix: $\begin{pmatrix} -1 & 8 \\ 2 & -6 \end{pmatrix}$

A. $\begin{pmatrix} -6 & -8 \\ -2 & -1 \end{pmatrix}$

B. $\begin{pmatrix} 1 & 2 \\ 8 & 6 \end{pmatrix}$

C. $\begin{pmatrix} 0.6 & 0.8 \\ 0.2 & 0.1 \end{pmatrix}$

D. $\begin{pmatrix} -0.1 & 0.2 \\ 0.8 & -0.6 \end{pmatrix}$

E. $\begin{pmatrix} 0.6 & -0.8 \\ -0.2 & 0.1 \end{pmatrix}$

24. If the standard order of operations rule is applied in reverse order (that is, additions and subtractions are done first and exponents are does last), what is the value of $2 \cdot 3 \wedge 2 + 3$?

A. 486

B. 21

C. 39

D. 7776

E. 24

25. Find the solution set: $e^{2\ln|x|} + 4x - \log_2 32 > 0$.

A. $(-\infty, 5) \cup (-1, \infty)$

B. $(-\infty, -5) \cup (1, \infty)$

C. $[1, \infty)$

D. $(0, \infty)$

E. $[-5, \infty)$

26. Suppose $\log_8 a + \log_8 b = \log_8 a \cdot \log_8 b$ and $\log_a b = 3$. Find a.

A. 9

B. 32

C. there is not enough information to answer

D. b^3

E. 16

27. The hour and minute hands on a clock are exactly 50 degrees apart at

A. 9:30

B. 5:36

C. 7:50

D. 2:20

E. 11:10

28. Evaluate: $\dfrac{\csc^2\left(\dfrac{-11\pi}{6}\right)\cot\left(\dfrac{2\pi}{3}\right)}{\sec\left(\dfrac{-2\pi}{3}\right)}$

A. $\dfrac{2\sqrt{3}}{3}$

B. $2\sqrt{3}$

C. $-\dfrac{2\sqrt{3}}{3}$

D. $-2\sqrt{3}$

E. $\dfrac{3\sqrt{2}}{2}$

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29. Find the area of the triangle with sides measuring 13, 16 and $\sqrt{41}$.

A. 36

B. 38

C. 40

D. 42

E. 44

30. Find the 125th element in the arithmetic sequence with $a_2 = 24$ and $a_5 = 18$.

A. -714

B. -224

C. 274

D. -222

E. -226

31. Find $\sin\left(\arctan u\right)$.

A. $\dfrac{u}{\sqrt{1+u^2}}$

B. $\dfrac{u}{\sqrt{1-u^2}}$

C. $\dfrac{\sqrt{1-u^2}}{u}$

D. $\dfrac{\sqrt{1+u^2}}{u}$

E. $\dfrac{u}{\sqrt{u^2-1}}$

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32. Simplify $\dfrac{\sec x + \csc x}{1 + \tan x}$.

A. $\sin x$

B. $\cos x$

C. $\tan x$

D. $\sec x$

E. $\csc x$

33. Write the equation of the conic section with eccentricity 1, focus $(-5,\ 2)$ and directrix $x = -1$.

A. $x = \dfrac{1}{8}(y-2)^2 - 5$

B. $x = \dfrac{1}{8}(y-2)^2 - 3$

C. $x = \dfrac{-1}{8}(y-2)^2 - 3$

D. $x = \dfrac{-1}{8}(y-2)^2 - 5$

E. $x = \dfrac{-1}{8}(y+2)^2 - 3$

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34. An experiment consists of rolling a six-sided die and then removing a ball from one of two jars. Jar A contains 1 red ball, 2 white balls and 3 green balls. Jar B contains 4 red balls and 5 white balls. If a "1" or a "4" lands face up when the die is rolled, a ball is removed from Jar A. Otherwise, a ball is removed from Jar B. Find the probability of selecting a white ball.

A. $\frac{1}{9}$

B. $\frac{13}{27}$

C. $\frac{11}{27}$

D. $\frac{29}{54}$

E. $\frac{4}{9}$

35. Which of these gives the distance from $P(x, y)$, an arbitrary point on the line $3x - y = 5$, to the point $(-2, 4)$ as a function of the *x* coordinate of *P*?

A. $\sqrt{10x^2 - 54x + 85}$

B. $\sqrt{10x^2 + 85}$

C. $\sqrt{10x^2 - 58x + 85}$

D. $\sqrt{10x^2 - 30x + 25}$

E. $\sqrt{10x^2 - 50x + 85}$