

$$1. \sin^{-1}\left(\frac{-\sqrt{3}}{2}\right) = \frac{-\pi}{3} \rightarrow A$$

$$2. \frac{-3-4+5}{(\sqrt{9+4+1})(\sqrt{1+4+25})} = \frac{-2}{\sqrt{420}} = \frac{-1}{\sqrt{105}} = \frac{-\sqrt{105}}{105} \rightarrow C$$

$$3. \text{ Transform equation to: } (x-6)^2 + (y+4)^2 = 45 \text{ so the center is } (6,-4)$$

Find the slope between center and tangent point(-2). Tangent line has a slope that is the negative reciprocal of this. So equation is: $x - 2y = -1 \rightarrow A$

$$4. \text{ Draw picture such that the vertex will be the lowest point } (0,4). 4p(y-4) = x^2$$

$$\text{plug in } (40,24). 4p \text{ equals } 80. \text{ Plug in } 30 \text{ for } X \text{ and solve for } Y. Y \text{ equals } \frac{61}{4} \rightarrow D$$

5. Use synthetic substitution and the rational root theorem: You will find the real solutions to be 2, -2 and -3, so the sum of the smallest and largest is $-1 \rightarrow D$

$$6. 3! \bullet 6! = 4320 \rightarrow C$$

7. Square both sides to get: $\sin^2 x + \cos^2 x + 2 \sin x \cos x = k^2$ therefore $\sin 2x = k^2 - 1$. Square both sides of this to get: $\sin^2 2x = k^4 + 1 - 2k^2$ substitute to get:

$$1 - \cos^2 2x = k^4 + 1 - 2k^2 \rightarrow \cos^2 2x = -k^4 + 2k^2 \rightarrow C$$

8. Expand and then

$$\text{substitute: } \cos \theta \cos \beta - \sin \theta \sin \beta = \left(\frac{4}{5}\right)\left(\frac{-12}{13}\right) - \left(\frac{3}{5}\right)\left(\frac{-5}{13}\right) = \frac{-48}{65} + \frac{15}{65} = \frac{-33}{65} \rightarrow A$$

$$9. \text{ Draw picture: } \tan \theta = \frac{h}{12} \text{ and } \tan 2\theta = \frac{h}{4}; 12 \tan \theta = 4 \tan 2\theta \rightarrow 3 \tan \theta = \frac{2 \tan \theta}{1 - \tan^2 \theta}$$

$$3 - 3 \tan^2 \theta = 2 \rightarrow \tan^2 \theta = \frac{1}{3} \rightarrow \tan \theta = \frac{\sqrt{3}}{3}; 12 \left(\frac{\sqrt{3}}{3}\right) = 4\sqrt{3} \rightarrow D$$

$$10. X = \frac{k}{Y^2} \rightarrow X = \frac{k}{\left(\frac{1}{-}\right)^2 Y^2} \rightarrow X = \frac{4k}{Y^2} \rightarrow B$$

11. The absolute value shifts the range to (0,3) and then the minus 4 shifts this down four units to $[-4, -1] \rightarrow B$

$$12. (1-i)^2 = -2i \rightarrow (-2i)^{\frac{k}{2}} = 2^{12} \rightarrow k = 24 \rightarrow C$$

13. Put the points in order and then use the determinant method for solving the area:

$$\begin{array}{ccccc} 1 & 4 & 2 & -6 & 1 \\ 2 & 5 & 7 & 1 & 2 \end{array} = \frac{1}{2} [5 + 28 + 2 - 12 - (8 + 10 - 42 + 1)] = 23 \rightarrow A$$

$$14. 2(x+3)(2x-3) = \frac{1}{2}(-6x+20) \quad 2(2x^2+3x-9) = -3x+10 \rightarrow 4x^2+9x-28=0$$

$$(4x-7)(x+4) = 0 \rightarrow x = \left(\frac{7}{4}, -4\right); -4 \text{ is extraneous so the only correct answer is } B.$$

$$15. 4 \cos x = 2 \csc x \rightarrow 2 \sin x \cos x = 1 \rightarrow \sin 2x = 1 \quad 2x = \frac{\pi}{2} + 2n\pi \rightarrow x = \frac{\pi}{4}, \frac{5\pi}{4}$$

The two intersection points are $\left(\frac{\pi}{4}, 2\sqrt{2}\right), \left(\frac{5\pi}{4}, -2\sqrt{2}\right)$ The slope is B.

$$16. 1 + \cot^2 x = \csc^2 x \rightarrow 1 + \frac{x^2}{y^2} = \frac{r^2}{y^2} \rightarrow x^2 + y^2 = r^2$$

$$1 + \cot^2 \frac{\theta}{7} + 1 + \cot^2 \frac{2\theta}{7} + 1 + \cot^2 \frac{3\theta}{7} + 1 + \cot^2 \frac{4\theta}{7} = \frac{5}{7}; \frac{5}{7} - 4 = \frac{-23}{7} \rightarrow B$$

$$17. \frac{2 \tan \theta}{1 - \tan^2 \theta} = \frac{3}{4} \rightarrow 3 - 3 \tan^2 \theta = 8 \tan \theta; (3 \tan \theta - 1)(\tan \theta + 3) = 0 \rightarrow \tan \theta = -3$$

Since cosine is negative in QII, we get C.

18. Since the coefficient of the 4th and 10th terms are the same, we can deduce that there are 13 terms, so $n = 12$. $a_8 = {}_{12}C_5 w^5 (-f)^7 \rightarrow D$

$$19. \text{First log both sides to get: } (\log Y)^2 = \log Y^5 - \log 10^6 \rightarrow (\log Y)^2 - 5 \log Y + 6 = 0$$

$$(\log Y - 2)(\log Y - 3) = 0; Y = 10^2 \text{ or } 10^3 \rightarrow B$$

20. $4p=12$ so $p=3$; Go up 3 units and then $2p$ or 6 units left and right to get a diameter of 12 or radius of 6. The center of the circle will be the focus(2,7). The equation of the circle is:

$$(x-2)^2 + (y-7)^2 = 36 \text{ expand this out and you get } x^2 + y^2 - 4x - 14y + 17 = 0 \rightarrow B$$

$$21. \text{Use pythagorean theorem to get: } (\log x)^2 + 4 \log x - 12 = 0 \rightarrow (\log x + 6)(\log x - 2)$$

$$X=100; \text{Use opposite over hypotenuse to get: } \frac{2}{2\sqrt{3}} \rightarrow C$$

$$22. (\cos \theta - \sin \theta)^2 = 1 - 2 \sin \theta \cos \theta = 1 - \sin 2\theta; \cos 4\theta = 1 - 2 \sin^2 2\theta = \frac{15}{17} \rightarrow \sin^2 2\theta = \frac{1}{17};$$

$$\sin 2\theta = \frac{\sqrt{17}}{17} \rightarrow 1 - \sin 2\theta = 1 - \frac{\sqrt{17}}{17} \rightarrow D$$

$$23. \tan(\phi - \theta) = \frac{\tan \phi - \tan \theta}{1 + \tan \phi \tan \theta} \text{ flip this fraction to solve for cotangent and you get:}$$

$$1 + \frac{1}{x} \cdot \frac{1}{y} \\ \frac{1}{\frac{1}{x} - \frac{1}{y}} \text{ multiply top and bottom by } xy \text{ to get B.}$$

$$24. \text{Set up a system of 3 equations and 3 variables: } x^2 + y^2 + cx + dy + f = 0$$

$$\text{substitute the 3 points to get: } c - 2d + f = -5$$

$$5c + 4d + f = -41$$

$$10c + 5d + f = -125$$

If you solve this system you get $c=-18$, $d=6$, and $f=25$; Complete some squares to transform the equation and you get: $x^2 - 18x + 81 + y^2 + 6y + 9 = -25 + 81 + 9$

The radius squared equals 65 so the answer is B.

$$25. \text{Use synthetic division with } -3 \text{ and you will get a quotient of: } x^2 - 4x + 7.$$

$$\text{Then use formula for product of roots } \frac{c}{a} = 7 \rightarrow A$$

26. Switch X and Y and resolve for Y to get inverse. Then set inverse equal to original function

and solve for N. $x = \frac{y+5}{y+n} \rightarrow xy + xn = y + 5$; $xy - y = 5 - xn \rightarrow \frac{5-nx}{x-1} = \frac{x+5}{x+n}$

$$x^2 + 4x - 5 = 5x + 5n - nx^2 - n^2x \rightarrow n = -1 \rightarrow A$$

27. $2 + 5 + 0 = 7 \rightarrow D$

28. Break this problem into two problems; First figure the possibilities for numbers 450-499 and then figure possibilities for 500-699. Add these together to get answer:

$1 \bullet 4 \bullet 6 + 2 \bullet 6 \bullet 6 = 24 + 72 = 96$; We divide this answer in half because we are only interested in odd numbers. The answer is 48 so D.

29.

$$\frac{\log_3 x}{\log_3 243} - \frac{\log_3 9}{\log_3 x} = \frac{3}{5} \rightarrow \frac{\log_3 x}{5} - \frac{2}{\log_3 x} = \frac{3}{5}$$

$$\rightarrow (\log_3 x)^2 - 10 = 3 \log_3 x \rightarrow (\log_3 x)^2 - 3 \log_3 x - 10 = 0$$

$$(\log_3 x - 5)(\log_3 x + 2) = 0 \rightarrow 3^5, 3^{-2} \rightarrow 3^3 = 27 \rightarrow C$$

30. An identity element is an element that when you perform an operation the value doesn't change. So we are looking for a column that is the same as the first column. Therefore the identity element is 2. answer is C.