

1. Find the product of the matrices: $\begin{bmatrix} 4 & 3 \\ 7 & 2 \end{bmatrix} X \begin{bmatrix} 8 & 5 \\ 9 & 6 \end{bmatrix}$. Express your answer as a matrix.
2. The range for y of $y = \cos\left(\frac{x}{7}\right)$ can be expressed as $\{y:k \leq y \leq w\}$. Find the value of $k - w$.
3. If $(-2, 3)$ is on the terminal ray of an angle in standard position, then the sine of this angle can be expressed, in simplest radical form, as $\frac{k\sqrt{w}}{w}$. Find the value of $k + w$.
4. The parametric equations representing a straight line are: $x(t) = 8 + t$ and $y(t) = 3 + 2t$. The slope-intercept form representing this same straight line can be expressed as $y = kx + w$. Find the value of $k + w$.
5. If $i = \sqrt{-1}$ and $f(x) = x^4 - 5ix^3 - 9x^2 + 7ix + 5$, find $f(2i)$.
6. A light house supervisor, 212 feet above the level surface of the water, spots a boat in the water at an angle of depression of $8^\circ 17'$. Rounded to the nearest foot, find the number of feet that the boat is from the point, at water level, directly below the supervisor.
7. The half-life of a certain substance is 8 days. On this basis, find the number of days for 6.49 grams of this substance to be reduced to 1 gram. Express your answer as a decimal rounded to 4 significant digits.
8. If $243^{22} - 7 = 236 + \sum_{k=0}^{20} (\log_9((81x)^{(243^k)}))$ and if $x = 9^y$ where y is an integer, find the value of y .
9. The two points $(2, 4)$ and $(1, -3)$ lie on a circle, and the center of this circle lies on the line $x + 2y = 0$. The equation of this circle can be expressed in the form $(x - k)^2 + (y - w)^2 = p$. Find the value of $k + w + p$.
10. Find the value of $\cos^2(74.618^\circ) + \sin^2(74.618^\circ)$.

11. The lengths of the three sides of a triangle are 2, 3, and $\sqrt{5}$. One of the angles of that triangle is selected at random. Find the probability that the sine of that angle is a rational number. Express your answer as a common fraction reduced to lowest terms.
12. If $x_1 = 91$ and for all integers n such that $n \geq 2$, $x_n = x_{(n-1)} + 7$, find x_7 .
13. If $f_1(x) = \frac{2x-1}{x+1}$ and for $n = 2, 3, 4, \dots$, $f_{(n+1)}(x) = f_1(f_n(x))$, then $f_{27}(x)$ can be expressed as $\frac{x-k}{wx-p}$. Find the value of $k+w+p$.
14. Danny is a positive influence 0.38 of the time; a neutral influence 0.41 of the time; and a negative influence the rest of the time. During the next 14 days, find the probability that Danny will be a positive influence exactly 5 days and a neutral influence exactly 6 days. Express your answer as a decimal rounded to 4 significant digits.
15. Find the value of $\lim_{k \rightarrow \infty} (1 + \frac{1}{k})^k$. Express your answer as a decimal rounded to 4 significant digits.
16. As an angle of x radians increases from 0 to 2π radians, in how many of the 4 Quadrants does $\tan(x)$ increase?
17. $9 + 13 + 17 + 21 + \dots + (4n + 5) = kn^2 + wn$. Find the value of $k + w$.
18. Find the value of k such that $k \neq 0$ for which $f(g(x)) = g(f(x))$ if $f(x) = x + k$ and $g(x) = kx + 5$.
19. In which Quadrant is cosine negative and cotangent positive? Express your answer as a Roman numeral.
20. \overline{AF} and \overline{DC} are the bases of trapezoid $AFCD$. B lies on \overline{AF} such that $\overline{CB} \parallel \overline{DA}$. \overline{CB} and \overline{DF} intersect at E . If $DC = 5$, $DE = 6$, $AE = 7$, and $BE = 3$, then the length of \overline{CE} , in simplest radical form, is $\frac{5 + \sqrt{k}}{w}$. Find the value of $k + w$.

A

Pre-Calculus

Name R02

School _____

_____ Correct X 2 pts. ea. =

School Code _____

Note: All answers must be written legibly in simplest form, according to the specifications stated in the Contest Manual. Exact answers are to be given unless otherwise specified in the question. No units of measurement are required.

1.
$$\begin{bmatrix} 59 & 38 \\ 74 & 47 \end{bmatrix}$$

11. $\frac{2}{3}$ (must be this reduced common fraction) _____

2. -2 _____

12. 133 _____

3. 16 _____

13. 5 _____

4. -11 _____

14. 0.05862 or $.05862$
(must be this decimal) _____

5. 3 _____

15. 2.718 (must be this decimal) _____

6. 1456 (feet optional) _____

16. 4 or $four$ or all _____

7. 21.59 (days optional)
(must be this decimal) _____

17. 9 _____

8. 58804 _____

18. 1 _____

9. 24 _____

19. III (must be a Roman numeral) _____

10. 1 _____

20. 71 _____