

PRE-CALCULUS INDIVIDUAL TEST – WANDO MATH TOURNAMENT 2009

Note – NOTA (choice E) means none of the answers are correct

1) Riders on a Ferris wheel travel in a circle in a vertical plane. A particular wheel has a radius of 24 feet and revolves at a constant rate of 1 revolution per $1\frac{1}{2}$ minutes. How many seconds does it take a rider to travel from the bottom of the wheel to a point 12 feet above the bottom of the wheel?

- A) 6 sec B) 9 sec C) 15 sec D) 30 sec E) NOTA

2) If x is a fraction which ranges from $\frac{1}{8}$ to $\frac{1}{3}$ inclusive and y is a fraction which ranges from $\frac{2}{3}$ to $\frac{15}{16}$ inclusive, what is the maximum value of $\frac{x}{y}$?

- A) $\frac{2}{15}$ B) $\frac{16}{45}$ C) $\frac{1}{2}$ D) 2 E) NOTA

3) Evaluate the principal value of $\arcsin\left(\sin\left(\frac{4\pi}{3}\right)\right)$

- A) $\frac{4\pi}{3}$ B) $\frac{5\pi}{3}$ C) $\frac{-\pi}{3}$ D) $\frac{-2\pi}{3}$ E) NOTA

4) Let f be a real valued function such that $f(x) + 3f\left(\frac{6027}{x}\right) = 2x$ for all $x > 0$. Find $f(3)$.

- A) 1507 B) 1506 C) 1505 D) 1504 E) NOTA

5) If $x \square y = \frac{y}{x} \cdot |x - y|$ then find $\frac{1}{3} \square \left(\frac{2}{3} \square 1\right)$

- A) $\frac{1}{4}$ B) $\frac{1}{6}$ C) $\frac{1}{7}$ D) $\frac{1}{9}$ E) NOTA

6) Put the four numbers in order from greatest to least: $1^{4000}, 2^{3000}, 3^{2000}, 4^{1000}$

- A) $2^{3000}, 3^{2000}, 4^{1000}, 1^{4000}$ B) $3^{2000}, 2^{3000}, 4^{1000}, 1^{4000}$ C) $2^{3000}, 4^{1000}, 3^{2000}, 1^{4000}$
 D) $3^{2000}, 4^{1000}, 2^{3000}, 1^{4000}$ E) NOTA

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7) If $f(x) = \log_4 x$, then what is $f\left(\frac{x}{4}\right) =$

- A) $\frac{f(x)}{4}$ B) $f(x)+4$ C) $f(x)-4$ D) $f(x)-1$ E) NOTA

8) $(x^{-4}y^8)^{\frac{-3}{4}}(x^3y^{-6})^{\frac{-2}{3}}$

- A) $\frac{x^2}{y^2}$ B) $\frac{x}{y^2}$ C) $\frac{y^2}{x}$ D) x^5y^{10} E) NOTA

9) Solve $e^{3x+4} = 14$

- A) $\frac{\ln\left(\frac{14}{4}\right)}{3}$ B) $\frac{\ln(14)}{3}$ C) $\frac{\ln(14)-4}{3}$ D) $\frac{\ln(14)}{12}$ E) NOTA

10) Find the sum of the amplitude, period and horizontal phase shift for the following function:

$$y = \pi \sin(\pi x + \pi)$$

- A) $3 + \pi$ B) $2 + \pi$ C) $1 + \pi$ D) $1 - \pi$ E) NOTA

11) Simplify $\frac{\sin x}{1 + \cos x} + \frac{1 + \cos x}{\sin x}$

- A) $2 \csc x$ B) $2 \sec x$ C) $\tan x$ D) $\sin x \cos x$ E) NOTA

12) Solve for x: $\begin{vmatrix} 1 & x & 1 \\ 1 & x & x \\ 1 & 1 & x \end{vmatrix} = 0$

- A) 0 B) 1 C) 2 D) 3 E) NOTA

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13) Find the sum of the positive solutions for the equation $(x^2)^{\log x^2} = 100x^2$

- A) $\frac{1+\sqrt{10}}{10}$ B) $\frac{10+\sqrt{10}}{10}$ C) $\frac{100+\sqrt{10}}{10}$ D) $\frac{1000+\sqrt{10}}{10}$ E) NOTA

14) The graph of the polar equation $r = 3\csc\theta$ is

- A) a line B) a circle C) a cardioid D) a lemniscate E) NOTA

15) Which of the following statements below are true?

- I. A rational function may never cross any of its asymptotes
 II. A rational function may have infinitely many vertical asymptotes
 III. The graph of $y = \frac{x^3}{x-2}$ has a slant asymptote

- A) All are true B) I only C) II only D) I and II E) NOTA

16) The graph of which of the following has exactly one positive real root?

- A) $f(x) = 3x^3 + 3x^2 + 4x + 5$ B) $f(x) = x^4 + 5x^3 + 2x + 6$
 C) $f(x) = 7x^5 + 3x^3 + 7x + 5$ D) $f(x) = -x^6 + 3x^5 + 2x^2 + 7$ E) NOTA

17) If $\sin \alpha = x$, find the cosine of the supplement of α .

- A) $\pi - x$ B) $-\sqrt{1-x^2}$ C) $\sqrt{x^2-1}$ D) $-x$ E) NOTA

18) Find the forty-second term in the expansion of $(2x - y)^{42}$

- A) y^{42} B) $-42xy^{41}$ C) $-84xy^{41}$ D) $-y^{42}$ E) NOTA

19) If $\log(x^4y) = r$ and $\log\left(\frac{x}{y^2}\right) = s$, then $xy =$

- A) $10^{\sqrt{r-s}}$ B) $\frac{r-s}{3}$ C) $10^{\frac{r-s}{3}}$ D) $3(r-s)$ E) NOTA

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20) Two cards are drawn from a standard deck without replacement. Find the probability that both cards show prime numbers.

- A) $\frac{16}{169}$ B) $\frac{64}{663}$ C) $\frac{11}{221}$ D) $\frac{20}{221}$ E) NOTA

21) To the nearest tenth of a degree, what is the angle of elevation of the sun when a 25m flagpole casts a shadow 42m long?

- A) 0.5 B) 30.8 C) 32.6 D) 59.2 E) NOTA

22) Two sides of a triangular lot meet at an angle of 75° . If each of these sides measures 100 ft in length, what is the perimeter of the lot to the nearest whole number?

- A) 240 B) 322 C) 341 D) 359 E) NOTA

23) Find the area bounded by the graph $f(x) = \sqrt{4-x^2}$ and the x-axis.

- A) $\frac{\pi}{2}$ B) 2π C) 4π D) 8π E) NOTA

24) Given that $f(x) = \frac{x^2 - 3x - 4}{7x^2 + 6x - 1}$, which of the following is true?

- A) $\lim_{x \rightarrow \infty} f(x) = 0$ B) There are two vertical asymptotes C) $f(-1) = \frac{5}{8}$
 D) There is a removable discontinuity at $x = -1$ E) NOTA

25) $\text{Cos}^{-1}\left(\frac{1}{2}\right) = x - 2y$ and $\text{Tan}^{-1}(1) = 2x + y$. Find $x + y$ in radians. Assume the principal value for Cos^{-1} and Tan^{-1} .

- A) $\frac{\pi}{12}$ B) $\frac{\pi}{10}$ C) $\frac{7\pi}{12}$ D) $\frac{\pi}{6}$ E) NOTA