

- Find the determinant of $\begin{bmatrix} 7 & 40 \\ 2 & 12 \end{bmatrix}$
- Using the same type of symbols as the given proposition, write the contrapositive of $\neg x \rightarrow y$
- If Triangle ABC has a right angle at C, which statement is **incorrect**?
 - $\sin(A) = \cos(B)$
 - $\sin(C) = 1$
 - $\tan(B) = \cot(A)$
 - $\csc(A) = \cos(B)$
 - $(AC)^2 + (BC)^2 = (AB)^2$For your answer, write the capital letter corresponding to the **incorrect** statement.
- Sarah invests \$1000 in Account A at an annual percentage rate of 11.6% compounded quarterly. At the same time, Sarah invests \$1000 in Account B at an annual percentage rate of 12.2% compounded annually. Rounded to the nearest dollar, find the absolute value of the difference of the amount in Account A and the amount in Account B at the end of 10 years.
- The focus of the parabola represented by $x^2 + 16x - 13y + 12 = 0$ is $(-8, k)$. Find the value of k . Express your answer as an exact decimal.
- An angle in standard position has a measure of x° , and the point $(-4, 3)$ lies on the terminal side of this angle. Then $\cos\left(\frac{x}{2}\right)^\circ = \frac{\sqrt{k}}{k}$ when expressed in simplest radical form. Find the value of k .
- On a plane, Emily is in the exterior of a circle and is 3 units from the circle. If the circle has a radius of 5 and Emily walks in a single random direction in the plane for 9 units, find the probability that the path of Emily's walk will intersect the circle. Express your answer as a decimal rounded to 4 significant digits.
- $\lim_{h \rightarrow 0} \frac{(x+2h)^3 - x^3}{h} = kx^2$. Find the value of k .
- If k and w are integers, $\sin(3x) = k(\sin(x)) + w(\sin^3(x))$. Find the value of $k + w$.

10. When (a, b) is reflected over a point or a line to (c, d) , then, by definition, (c, d) is the image of (a, b) .
The point $(-5, 4)$ is reflected over each of the following six points or lines:
 $(2, 1)$ $(3.5, 6)$ $(2.25, 0.5)$ $y = 6.5$ $x = 2$ $y = x$
If two of the distinct images are selected at random, find the probability that the sum of the coordinates of each of the two distinct images is an integer. Express your answer as a common fraction reduced to lowest terms.
11. If the cross product of the two vectors $(-2.1, 6.8, 4.7)$ and $(1.4, 3.5, 2.8)$ is (x, y, z) , find $|x + y + z|$. Express your answer as an exact decimal.
12. If $i = \sqrt{-1}$, then \sqrt{i} can be expressed as $x + yi$ where $x > 0$ and $y > 0$. Find the value of $x + y$.
13. Find the ordered triple of real numbers (p, q, r) such that
 $p(x - 1)(x - 2) + q(x - 1)(x + 2) + r(x + 2)(x - 2) = 60x - 12$ for all values of x .
14. A plane contains the point $(2, -5, 8)$ and is perpendicular to the vector $(1, 6, -3)$. The equation of this plane can be written in the form $x + ky + wz = p$. Find the value of $k + w + p$.
15. Let x and y be real numbers that satisfy all four of the following conditions:
 $x + 4y \leq 12$ $3x - 2y \geq -6$ $x + y \geq -2$ $3x - y \leq 10$
Find the maximum possible value of $4x + 2y + 7$.
16. Find the value of $\frac{1}{3} + \frac{4}{15} + \frac{7}{75} + \frac{10}{375} + \dots + \frac{3n-2}{3(5)^{(n-1)}} + \dots$ Express your answer as a common fraction reduced to lowest terms.
17. A person writes down 5 different integers at random from the 25 integers from 1 to 25 inclusive. Each of the 25 integers is then called off one at a time in a random order; no number is called off more than once. As soon as all 5 of the person's numbers have been called off, the person yells: "Bingo." Find the probability that the person will yell "Bingo" when the 13th number is called. Express your answer as a decimal rounded to 4 significant digits.
18. If e is the base for natural logarithms, how many distinct real roots for x exist for the equation $e^x - e^{-x} = -1$?

19. Rounded to the nearest tenth of a year, how many years will it take a sum of money to double if invested at an annual percentage rate of 9.5% compounded continuously?
20. Given: $x > 0, y > 0, x^3 + y^3 = kxy(x + y)$ where k is a positive integer. For all such values of x and y , $\log\left(\frac{x+y}{20}\right) = \frac{\log(x^2y + xy^2)}{3}$. Find the value of k .

A

Pre-Calculus

Name S02

School _____

Correct X **2** pts. ea. =

School Code _____

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

1. 4

2. $-y \rightarrow x$

3. D

4. 24 (\$ optional)

5. -0.75 or -.75
(must be this decimal)

6. 10

7. 0.2149 or .2149
(must be this decimal)

8. 6

9. -1

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

11. 1.82 (must be th

12. $\sqrt{2}$

13. $(-11, 27, -16)$ (must be this ordered trip

14. -49

15. 27

16. $\frac{35}{48}$ (must be
commo

17. 0.009317 or .009317
(must be this decimal)

18. 1

19. 7.3 (years optional)
(must be this decimal)

20. 7997

ITEM ANALYSIS
85 Papers
Percent of Answers Corr
1A Pre-Calculus

1.	84%	11.	10%
2.	45%	12.	31%
3.	78%	13.	12%
4.	21%	14.	0%
5.	9%	15.	22%
6.	17%	16.	15%
7.	3%	17.	0%
8.	43%	18.	57%
9.	9%	19.	37%
10.	15%	20.	2%

ITEM ANALYSIS
122 Papers
Percent of Answers Cor
2A Pre-Calculus

1.	88%	11.	17
2.	49%	12.	50
3.	86%	13.	18
4.	39%	14.	2
5.	26%	15.	28
6.	26%	16.	38
7.	8%	17.	1
8.	50%	18.	7
9.	16%	19.	6
10.	14%	20.	