1. A sequence is defined recursively by $a_{(n+1)} = 2a_n + 3$ for all integers $n \geq 1$. If $a_{10} = 17$, find the value of a_{11}.

2. Given that the polynomial equation $x^5 + kx^4 + wx^3 + px^2 + fx + g = 0$ has 5 distinct real roots for x, how many times does the graph of $y = x^5 + kx^4 + wx^3 + px^2 + fx + g$ intersect the $x - axis$?

3. **(Multiple Choice)** For your answer write the **capital letter** which corresponds to the correct choice.

   The quadrants which contain points of the graph of $y = -5(x+1)^2 - 12$ are:

   A) I and III B) I and II C) II and III D) II and IV E) III and IV

   Note: Be certain to write the correct capital letter as your answer.

4. Find the value of the indicated sum: $\sum_{1}^{4}(2.613k + 43.43)$. Express your answer as an **exact decimal.**

5. The eighth term of a geometric sequence of real terms is 32, while the thirteenth term is 1024. Find the third term of this geometric sequence of real terms.

6. Given that f is an **odd** function and that $f(2) = 4$, find the value of $f(-2)$.

7. All lengths of the sides of a triangle are integers. The sine of the middle-sized angle of the triangle is $\frac{\sqrt{3}}{2}$. The length of one of the adjacent sides of the triangle for that angle is 15. Find the smallest perimeter for such a triangle.

8. If $\sin(x) = \frac{4}{5}$ and $\cot(y) = \frac{12}{5}$, then there are two possible answers for $\tan(x - y)$. Find the sum of these two possible distinct answers. Express your answer as an improper fraction reduced to lowest terms.

9. Let k, w, and p be the roots of $x^3 - 16x^2 + 76x - 96 = 0$, and let $(k+1)$, $(w+2)$, and $(p+3)$ be the roots for y of $y^3 + ay^2 + by - 308 = 0$. Find the value of $(a+b)$.

10. $(a+b)^n$ is expanded for a particular positive integer n and written in decreasing powers of a. Specific positive integers are then substituted for a and b in each term. The string of terms produced includes the three consecutive numbers (separated by + signs) 1620, 4320, and 5760. Find the next number after 5760 in this string of terms.

11. In the real-numbered function, find the sum of all distinct negative integers for x such that $\log_{\left(\frac{1}{2}\right)}(x+15) \le 0$.

12. Find the smallest positive integer k such that all the zeros for x of the polynomial $x^3 - kx^2 + 216x$ are integers and such that all the zeros for y of the polynomial $3y^2 - 2ky + 216$ are integers.

13. If $A = 2\begin{bmatrix} 2 & 3 \\ 1 & -3 \end{bmatrix} - 3\begin{bmatrix} 5 & 4 \\ 1 & 7 \end{bmatrix}$, find the value of $\det(A)$.

14. It is known that 475 logs are piled in such a way that each row has one more log than the row above. If the top row has as few logs as necessary to stack all 475 logs, find the number of logs in the bottom row.

15. Let e be the base for natural logarithms and let $\ln$ be the symbol for natural logarithms. Find, written as a single fraction in terms of e, the value of x such that $\ln(x)-\ln(x-1)=1$.

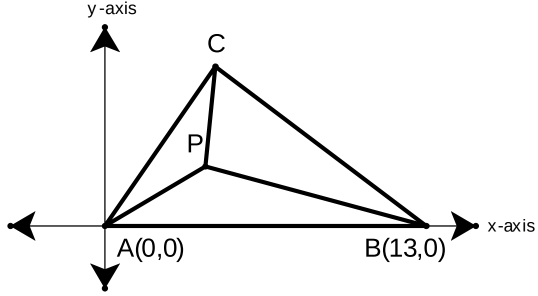
16. Given that $\sin(A)=\frac{2}{5}$ and $0<A<\frac{\pi}{2}$ (where A is measured in radians). Then $\sin(2A)$ can be expressed in simplest radical form as $\frac{k\sqrt{w}}{p}$ where k and p are relatively prime integers and $p>0$. Find the value of $(k+w+p)$.

17. Two fair, standard cubical dice are thrown. Find the probability that the sum of the numbers showing on the uppermost faces is less than or equal to 5. Express your answer as a common fraction reduced to lowest terms.

18. Let $C(n,k)=\frac{n!}{k!(n-k)!}$ where n and k represent positive integers. Find the **sum** of all distinct values of n such that $7<C(n,4)<106$.

19. If $f(x)=\frac{x}{x^2-x-2}$, the asymptotes are $x=k$, $x=w$, and $y=p$. Find the value of $(k+w+p)$.

20. In the diagram with coordinates as shown, $AC=14$, and $BC=15$. The ratio of the area of ΔPAB to the area of ΔPAC to the area of ΔPBC is $1:2:3$. Find the **ordered pair** that represents point P. Express your answer as an **ordered pair** with **each member** of the ordered pair expressed as an improper fraction reduced to lowest terms.



2011 RA

Pre-Calculus

Name ANSWERS

School ____________________

(Use full school name – no abbreviations)

______ **Correct X 2 pts. ea. =** [ ]

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. 37

2. 5

3. E (Must be this capital letter.)

4. 199.85 (Must be this decimal.)

5. 1

6. -4

7. 35

8. $-\frac{375}{112}$ or $\frac{-375}{112}$ (Must be this reduced improper fraction.)

9. 127

10. 3840

11. -105

12. 33

13. 291

14. 31

15. $\frac{e}{e-1}$ or $\frac{-e}{1-e}$ (Must be a single fraction.)

16. 50

17. $\frac{5}{18}$ (Must be this reduced common fraction.)

18. 21

19. 1

20. $\left(\frac{68}{13}, \frac{28}{13}\right)$ (Must be this ordered pair with reduced improper fractions.)