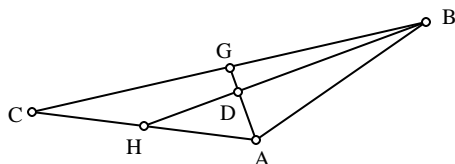


Part I: Multiple Choice (20 Problems)

1. Let $f(x)$ be a quadratic polynomial such that $f(3) = 15$ and $f(-3) = 9$. Find the coefficient of x in $f(x)$.
- a) 2 b) 3 c) -2 d) -3 e) 1
-
2. Find the sum of all values of x so that $16^{(x^2+3x-1)} = 8^{(x^2+3x+2)}$.
- a) 0 b) 3 c) -3 d) -5 e) none of these
-
3. Find the sum of all values of $x > 0$ for which $(\log_{27} x^3)^2 = \log_{27} x^6$.
- a) 1 b) 5 c) 0 d) 10 e) none of these
-
4. If $|x| - x + y = 10$ and $x + |y| + y = 12$, then $x + y$ is equal to
- a) $\frac{26}{5}$ b) $-\frac{26}{5}$ c) 0 d) $\frac{42}{5}$ e) none of these
-
5. If $x + \frac{1}{x} = k$, find $x^5 + \frac{1}{x^5}$. Write the answer in the form of $ak^5 + bk^4 + ck^3 + dk^2 + ek + f$ and find the sum of the coefficients.
- a) 3 b) 1 c) 0 d) 5 e) none of these
-
6. An equilateral triangle, with sides of 10 inches, is inscribed in a square ABCD in such a way that one vertex is at A, another vertex on \overline{BC} and one on \overline{CD} . Find the area of the square.
- a) $25(2 - \sqrt{3})$ b) $25(2 + \sqrt{3})$ c) 25
- d) $\frac{100}{2 + \sqrt{3}}$ e) none of these
-
7. How many digits are in $17^{10,000}$?
- a) 12,304 b) 1,700 c) 10,000 d) 12,305 e) none of these
-
8. If $\tan A + \tan B + \tan C = k$, $0 < k < 10$, and $m\angle A + m\angle B + m\angle C = 180^\circ$, find $\tan A \tan B \tan C$.
- a) $\frac{1}{4}k$ b) $4k$ c) k^3 d) k e) none of these
-

9. Let S be a set with 100 elements. How many subsets does S have which contain at least 50 elements:
- a) 1.217×10^{30} b) 6.843×10^{29} c) 1.167×10^{30}
 d) 1.009×10^{29} e) none of these
-
10. It usually takes Johnny 8 hours to mow the yard. Frankie can do it in 6 hours. Johnny got Frankie to help one Saturday morning, but when one-half of the lawn was mowed, Frankie quit and Johnny had to finish by himself. How long did Johnny mow altogether including the time he worked with Frankie?
- a) $5\frac{2}{5}$ hrs. b) $5\frac{1}{3}$ hrs. c) $4\frac{4}{5}$ hrs. d) $5\frac{5}{7}$ hrs. e) none of these
-
11. Johnny figures that since the final exam counts as two tests, he only needs a 28 to have a 70 average. Even if he makes a 100 he will still only have an 88 average. What is the lowest score Johnny can make on the final and still have an 80 average?
- a) 65 b) 66 c) 68 d) 70 e) 72
-
12. If $\begin{cases} x \sec q + y \tan q = 2 \cos q \\ x \tan q + y \sec q = \cot q \end{cases}$, find what y equals.
- a) $\frac{\cos 2q}{\sin q}$ b) $\sin q$ c) $\cos q$ d) $\sin 2q$ e) none of these
-
13. If the 14 blocks must be filled with whole numbers so that the sum of any three consecutive blocks has a total of 18, find x .
- | | | | | | | | | | | | | | |
|--|--|--|---|--|--|--|---|--|--|--|---|--|--|
| | | | 7 | | | | x | | | | 8 | | |
|--|--|--|---|--|--|--|---|--|--|--|---|--|--|
- a) 3 b) 5 c) 7 d) 4 e) 8
-
14. If $(532)_b = 4(148)_b$, for base $b > 1$, the b is in which range?
- a) $1 \leq b \leq 5$ b) $6 \leq b \leq 10$ c) $11 \leq b \leq 15$
 d) $16 \leq b \leq 20$ e) $21 \leq b$
-
15. Given $x * y = x + y + 1$, and a^{-1} means the inverse of a with respect to " $*$ ". Calculate $(2 * 3)^{-1} * 2^{-1} * 3^{-1}$.
- a) -16 b) -15 c) 15 d) 16 e) none of these

16. In $\triangle ABC$ $\overline{BC} = 24$, $\overline{AC} = 18$ and the medians to sides \overline{BC} and \overline{AC} are perpendicular. Find \overline{AB} .

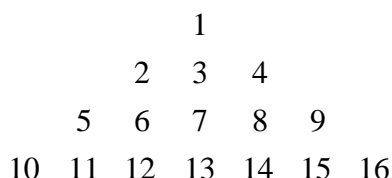


- a) 30 b) $15\sqrt{2}$ c) $6\sqrt{5}$ d) $5\sqrt{6}$ e) none of these
-
17. One day when Johnny had a cold he was interested in how many times the sheets of toilet paper were wrapped around the roll. In order to find out, he got out his ruler and made the following measurements:
- | | |
|--------------------------------|--|
| Each sheet is 5.25 inches long | The diameter of the full roll is 4.25 inches |
| There are 400 sheets | The diameter of the empty roll is 1.5 inches |
- Approximately how many times is the paper wrapped around the roll?
- a) 233 b) 730 c) 400 d) 326 e) 285
-
18. The sums of five distinct numbers taken two at a time are given below. Find the product of the smallest three numbers.
- | | | | | |
|------|------|------|------|------|
| 1286 | 1088 | 1237 | 1713 | 424 |
| 573 | 1049 | 375 | 851 | 1000 |
- a) 11102250 b) 22201150 c) 11101111 d) 12125011 e) none of these
-
19. In a three-dimensional rectangular coordinate system, find the total surface area of the solid defined by $|x| + |y| + |z| \leq 1$.
- a) $4\sqrt{2}$ b) $2\sqrt{6}$ c) $4\sqrt{3}$ d) $2\sqrt{5}$ e) none of these
-
20. In a 30-ft. long, 12-ft. wide, and 12-ft. high room, an ant and a pot of honey are on opposite 12 ft. x 12 ft. walls. The ant is on the north wall equidistant from the east and west walls, but one foot from the ceiling and the honey pot is on the south wall equidistant from the east and west walls, but one foot from the floor. What is the shortest distance that the ant must crawl to get to the honey?
- a) 39.6 b) 41.7 c) 42 d) 40 e) 40.7
-

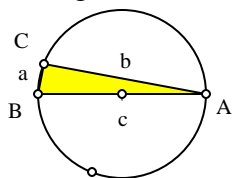
Part II: Integer Answer (15 Problems)

1. If $(x + iy)^3 = -74 + ki$, find the absolute value of k given that $x = 1$ and $i = \sqrt{-1}$.

2. If this lattice was continued, what number would be directly below 1000?



3. Given: $\triangle ABC$ is inscribed in the semicircle with diameter \overline{AB} . The area of $\triangle ABC$ equals $\frac{2}{9}$ of the area of the semicircle. Find the measure of the smallest angle in $\triangle ABC$ to the nearest degree.



4. Suppose that 1 and -7 are roots of $x^3 + ax^2 + bx + c = 0$, and that $a + b = -15$. Find the final root.
5. A horizontal line intersects $y = x^4 + 10x^3 - 4x^2 - 150x + 171$ in exactly four different points. Find the absolute value of the sum of the x -coordinates of these four points.
6. Frankie and Johnny are $\frac{11}{25}$ of the way across a bridge when they hear a train coming behind them. Frankie runs toward the train and Johnny away from it. Luckily, both just made it off the bridge in the nick of time. Afterwards they learn that the train was traveling 100 mph. Frankie and Johnny ran at the same rate. How fast did they run?

7. Frankie and Johnny are sweethearts so Johnny always walks by to pick up Frankie on the way to school. If Johnny lives 3 blocks south and 4 blocks west of Frankie and Frankie lives 5 blocks west and 2 blocks south of the school, how many ways can Johnny walk to school if he will walk any route as long as he always walks north or east?
-

8. The polynomial $x^4 - 50x^2 + k = 0$ has four distinct real zeroes and these zeroes are equally spaced on the real number line. Determine the value of k .
-

9. Find the largest integer m so that 5^7 can be written as the sum of exactly m consecutive positive integers.
-

10. Frankie and Johnny go skating at the track. Frankie likes to skate because she is much faster than Johnny is. Even when she takes the outside lane and gives Johnny the inside lane, she can make it around the track in 5 minutes, whereas it takes Johnny 6 minutes. So Johnny does not like to skate all that long. He notes that when they start they are lined up with the flagpole at the very center of the circular track and says that he will skate until the skaters and the flagpole lie on the same straight line. If they go in the same direction and maintain constant speeds, how many minutes do they skate?
-

11. Find the sum of all positive integers n so that $n^4 - 360n^2 + 400$ is a positive prime.
-

12. Find the sum of the 4 positive integer values which make $n^2 + n + 109$ a perfect square.
-

13. The equation $x^2 - y^2 = 1,000,001$ has only two solutions where x and y are both in the set $S = \{1, 2, 3, 4, \dots\}$. Find the smallest value of x in the solution set.
-

14. If one-hundred factorial ($100!$) base 10 is converted to base 6, how many zeroes will be at the end of the base 6 numeral?
-

15. Find the smallest positive integer which has exactly 24 positive integer divisors.
-