

NMC SAMPLE PROBLEMS: GRADE 8

1. A right triangle has lengths of 4 and 8 in sides. What is the length of hypotenuse (the longest side)?

(a) $4\sqrt{2}$ (b) 10 (c) $4\sqrt{5}$ (d) $4\sqrt{3}$ (e) 12

Answer: (c)

2. An isosceles triangle has the base length of 6 and each side of length 12. What is the area of the triangle?

(a) $9\sqrt{15}$ (b) 27 (c) $35\sqrt{3}$ (d) $35\sqrt{5}$ (e) 35

Answer: (a)

3. A cone has the base circle with the radius of 4 and the height of 6. What is the volume of the cone?

(a) 16π (b) 32π (c) $16\pi^2$ (d) 24π (e) 12π

Answer: (b)

4. Suppose you are randomly taking two marbles from a bag of 14 marbles with 7 red, 4 yellow and 3 black. What is the probability that you picked one red and one black marbles?

(a) $\frac{3}{7}$ (b) $\frac{3}{13}$ (c) $\frac{2}{14}$ (d) $\frac{3}{4}$ (e) $\frac{1}{2}$

Answer: (b)

5. The boiling temperature of water is at 100 degrees in Celsius. What is the boiling temperature in Fahrenheit?

(a) 200 (b) 50 (c) 212 (d) 32 (e) 235

Answer: (c)

6. A line intersects two points $(-1, -1)$ and $(1, 3)$. Which one of the following expressions represents the line?

(a) $y = x$ (b) $y = x + 1$ (c) $y = x - 1$ (d) $y = 2x$ (e) $y = 2x + 1$

Answer: (e)

7. Solve for t in $23 + 18t = 6t - 37$.

(a) $t = 3$ (b) $t = 5$ (c) $t = -3$ (d) $t = -5$ (e) $t = -2$

Answer: (d)

8. Solve for r in $\frac{r}{3} + 22 = 37$.

- (a) $r = 15$ (b) $r = 3$ (c) $r = 30$ (d) $r = 10$ (e) $r = 45$

Answer: (e)

9. Calculate $15 - 3 \times 5$.

- (a) 60 (b) 30 (c) 0 (d) 40 (e) 50

Answer: (c)

10. Amy plans to plant flowers and buys 23.5 pounds of potting soil. What is the minimum number of pots that Amy can fill when each pot can be filled with 1.35 pounds?

- (a) 17 (b) 15 (c) 18 (d) 14 (e) 19

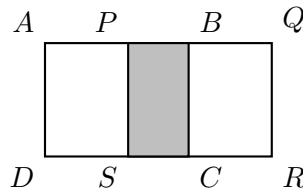
Answer: (c)

11. Angie, Bob, Carlos, and Dan are randomly seated around a square table, one person to a side. What is the probability that Angie and Carlos are seated opposite each other?

- (a) $\frac{1}{4}$ (b) $\frac{1}{3}$ (c) $\frac{1}{2}$ (d) $\frac{2}{3}$ (e) $\frac{3}{4}$

Answer: (b)

12. Two congruent squares, $ABCD$ and $PQRS$, have side length 15. They overlap to form the 15 by 25 rectangle $AQRD$ as shown. What percentage of the area of rectangle $AQRD$ is shaded? (*Figure not drawn to scale!*)



- (a) 15 (b) 18 (c) 20 (d) 24 (e) 25

Answer: (c)

13. There are 180 students at Coldspring Middle School, where the ratio of boys to girls is 5:4. There are 270 students at Warmspring Middle School, where the ratio of boys to girls is 4:5. The two schools hold a dance party and all students from both schools attend. What fraction of the students at the dance party are girls?

- (a) $\frac{7}{18}$ (b) $\frac{7}{15}$ (c) $\frac{22}{45}$ (d) $\frac{1}{2}$ (e) $\frac{23}{45}$

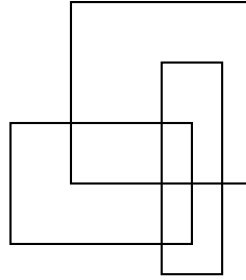
Answer: (e)

14. Let w , x , y , and z be whole numbers. If $2^w \times 3^x \times 5^y \times 7^z = 588$, what does $2w + 3x + 5y + 7z$ equal?

- (a) 21 (b) 25 (c) 27 (d) 35 (e) 56

Answer: (a)

15. How many rectangles are in the figure below?



- (a) 8 (b) 9 (c) 10 (d) 11 (e) 12

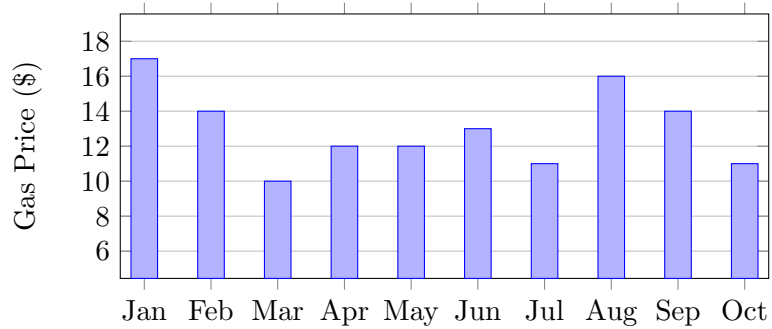
Answer: (c)

16. If $a * b = \frac{a \times b}{a + b}$ for a, b positive integers, then what is $5 * 10$?

- (a) $\frac{3}{10}$ (b) 1 (c) 2 (d) $\frac{10}{3}$ (e) 50

Answer: (d)

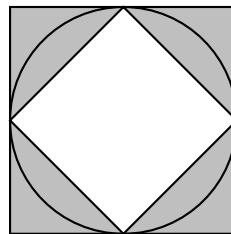
17. The graph shows the price of five gallons of gasoline during the first ten months of the year. By what percent is the highest price more than the lowest price?



- (a) 50% (b) 62% (c) 70% (d) 89% (e) 100%

Answer: (c)

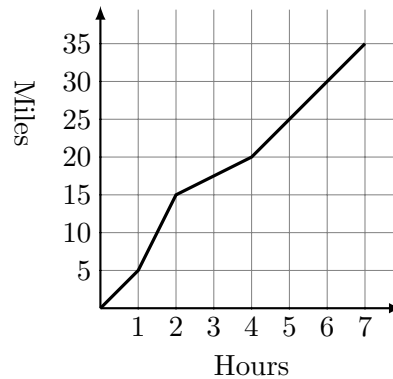
18. A circle with radius 1 is inscribed in a square and circumscribed about another square as shown. Which of the following is closest to the ratio of the shaded area in the circle to the total shaded area?



- (a) $\frac{1}{2}$ (b) 1 (c) $\frac{3}{2}$ (d) 2 (e) $\frac{5}{2}$

Answer: (a)

19. Ken takes a long bike ride on a hilly highway. The graph indicates the miles traveled during the time of his ride. What is Ken's average speed for the entire ride in miles per hour?



- (a) 2 (b) 2.5 (c) 4 (d) 4.5 (e) 5

Answer: (e)

20. What is the sum of the mean, median, and mode of the numbers 2,3,0,3,1,4,0,3?

- (a) 6.5 (b) 7 (c) 7.5 (d) 8.5 (e) 9

Answer: (c)

21. As Amy rides her bicycle on a long straight road, she spots Bob skating in the same direction a half mile in front of her. After she passes him, she can see him in her rear view mirror until he is a half mile behind her. Amy rides at a constant rate of 12 miles per hour, and Bob skates at a constant rate of 8 miles per hour. How many minutes have passed since Amy first spotted Bob until she lost him in the rear view mirror?

- (a) 6 (b) 8 (c) 12 (d) 15 (e) 16

Answer: (d)

22. Father takes a bus to the City for work, and buses are dispatched at every 20 minutes. Assuming that there are no bus delays, how long does your Father have to wait at a bus stop on the average if he comes to the bus stop without prior information on when buses left the bus depot?

- (a) 5 (b) 10 (c) 12.5 (d) 15 (e) 20

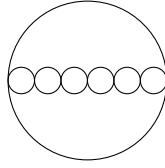
Answer: (b)

23. Amy's video game lets her design the appearance of her character. There are 4 different bodies and 3 faces to choose from. How many different characters can Amy design?

- (a) 3 (b) 4 (c) 7 (d) 12 (e) 20

Answer: (d)

24. Six pepperoni circles will exactly fit across the diameter of a 12-inch pizza when placed as shown. If a total of 24 pepperoni circles are placed on this pizza, what is the fraction of the pizza covered by pepperoni?



- (a) $\frac{1}{2}$ (b) $\frac{2}{3}$ (c) $\frac{3}{4}$ (d) $\frac{5}{6}$ (e) $\frac{7}{8}$

Answer: (b)

25. The top of one tree is 16 feet higher than the top of another tree. The heights of the two trees are in the ratio 3:4. In feet, how tall is the taller tree?

- (a) 48 (b) 64 (c) 80 (d) 96 (e) 112

Answer: (b)

26. Of the 500 balls in a large bag, 80% are red and the rest are blue. How many of the red balls must be removed from the bag so that 75% of the remaining balls are red?

- (a) 25 (b) 50 (c) 75 (d) 100 (e) 150

Answer: (d)

27. The lengths of the sides of a triangle are three consecutive integers. The length of the shortest side is 30% of the perimeter. What is the length of the longest side?

- (a) 7 (b) 8 (c) 9 (d) 10 (e) 11

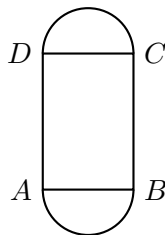
Answer: (e)

28. A square and a circle have the same area. What is the ratio of the side length of the square to the radius of the circle?

- (a) $\frac{\sqrt{\pi}}{2}$ (b) $\sqrt{\pi}$ (c) π (d) 2π (e) π^2

Answer: (b)

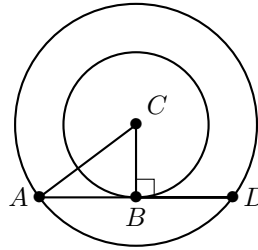
29. A decorative window has a rectangle with semicircles on either end. The ratio of AD to AB is 3 : 2, and $AB = 30$ inches. What is the ratio of the area of the rectangle to the sum of areas of two semicircles?



- (a) 2 : 3 (b) 3 : 2 (c) 6 : π (d) 9 : π (e) 30 : π

Answer: (c)

30. Two circles in the picture have the same center C . The line AD is tangent to the inner circle at B , AC is 10, and the line AD has length 16. What is the area between the two circles?



- (a) 36π (b) 49π (c) 64π (d) 81π (e) 100π

Answer: (c)

31. In a room, $\frac{2}{5}$ of all the people are wearing gloves, and $\frac{3}{4}$ of the people are wearing hats. What is the minimum number of people in the room wearing both gloves and hats?

- (a) 3 (b) 5 (c) 8 (d) 15 (e) 20

Answer: (a)

32. Amy bought a novel, and read $\frac{1}{5}$ of the pages plus 12 more on the first day. On the second day, she read $\frac{1}{4}$ of the remaining pages, plus 15 pages. On the third day, she read $\frac{1}{3}$ of the remaining pages, plus 18 pages. She then realized that there were only 62 pages left to read. How many pages are in this book?

- (a) 120 (b) 180 (c) 240 (d) 300 (e) 360

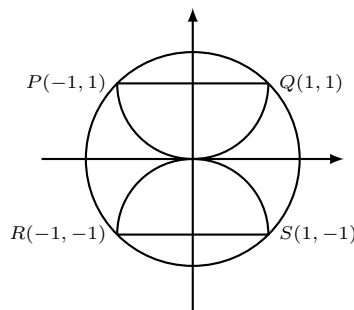
Answer: (c)

33. The hundreds digit of a three-digit number is 2 more than the units digit. The digits of the three-digit number are reversed, and the result is subtracted from the original three-digit number. What is the units digit of the result?

- (a) 0 (b) 2 (c) 4 (d) 6 (e) 8

Answer: (e)

34. Semicircles POQ and ROS pass through the center O of a circle. What is the ratio of the sum of the areas of the two semicircles to the area of the larger circle?



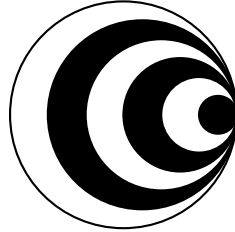
- (a) $\frac{\sqrt{2}}{4}$ (b) $\frac{1}{2}$ (c) $\frac{2}{\pi}$ (d) $\frac{2}{3}$ (e) $\frac{\sqrt{2}}{2}$

Answer: (b)

35. Given three numbers 10^8 , 5^{12} , and 2^{24} , which one is a correct ordering of the numbers ?
- (a) $2^{24} < 10^8 < 5^{12}$ (b) $2^{24} < 5^{12} < 10^8$ (c) $5^{12} < 2^{24} < 10^8$
 (d) $10^8 < 5^{12} < 2^{24}$ (e) $10^8 < 2^{24} < 5^{12}$

Answer: (a)

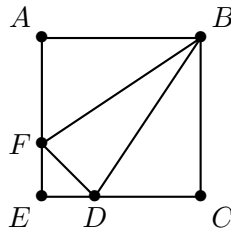
36. In the design as shown, the smallest black circle has radius 2 inches, with each successive circle's radius increasing by 2 inches. Approximately what percent of the design is black?



- (a) 42 (b) 44 (c) 45 (d) 46 (e) 48

Answer: (a)

37. In square $ABCE$, $AF = 2FE$ and $CD = 2DE$. What is the ratio of the area of triangle BFD to the area of square $ABCE$?



- (a) $\frac{1}{6}$ (b) $\frac{2}{9}$ (c) $\frac{5}{18}$ (d) $\frac{1}{3}$ (e) $\frac{7}{20}$

Answer: (c)

38. Ten tiles have numbers 1 through 10 painted on them, and are placed face down. You randomly pick a tile and throw a die, and multiply the two numbers from a tile and the die. What is the probability that the product is a square?

- (a) $\frac{1}{10}$ (b) $\frac{1}{6}$ (c) $\frac{11}{60}$ (d) $\frac{1}{5}$ (e) $\frac{7}{30}$

Answer: (c)

39. How many positive integer value of n can have both $n/3$ and $3n$ three-digit whole numbers?

- (a) 12 (b) 21 (c) 27 (d) 33 (e) 34

Answer: (a)

40. Consider all rectangles with integer side lengths and a perimeter of 50 units. What is the difference between the largest and smallest areas of the rectangles?

- (a) 76 (b) 120 (c) 128 (d) 132 (e) 136

Answer: (d)

41. Three *A*s, three *B*s, and three *C*s are placed in the nine spaces so that each row and column contain one of each letter. If *A* is placed in the upper left corner, how many such arrangements are possible?

A		

- (a) 2 (b) 3 (c) 4 (d) 5 (e) 6

Answer: (c)

42. Given three boxes, you weigh pairs of them in every possible way with weights of 122, 125, and 127 pounds. What is the combined weight of the three boxes?

- (a) 160 (b) 170 (c) 187 (d) 195 (e) 354

Answer: (c)

43. A ball is dropped from a height of 3 meters. On its first bounce, it rises to a height of 2 meters. It keeps falling and bouncing back up to $\frac{2}{3}$ of the height it reached in the previous bounce. On which bounce will it first not rise to a height of 0.5 meter?

- (a) 3 (b) 4 (c) 5 (d) 6 (e) 7

Answer: (c)

44. The average age of 6 people in room *A* is 40. The average age of 4 people in room *B* is 25. If the two groups are combined, what is the average age of the combined 10 people ?

- (a) 32.5 (b) 33 (c) 33.5 (d) 34 (e) 35

Answer: (d)

45. The investment of \$100 suffered a 15% loss in the first year. In the 2nd year, however, the remaining investment after the first year showed a 20% gain. Over the two-year period, what is the change in the investment?

- (a) 5% loss (b) 2% loss (c) 1% gain (d) 2% gain (e) 5% gain

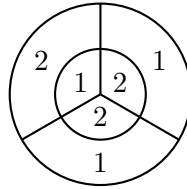
Answer: (d)

46. In how many ways can 10,001 be written as the sum of two primes?

- (a) 0 (b) 1 (c) 2 (d) 3 (e) 4

Answer: (a)

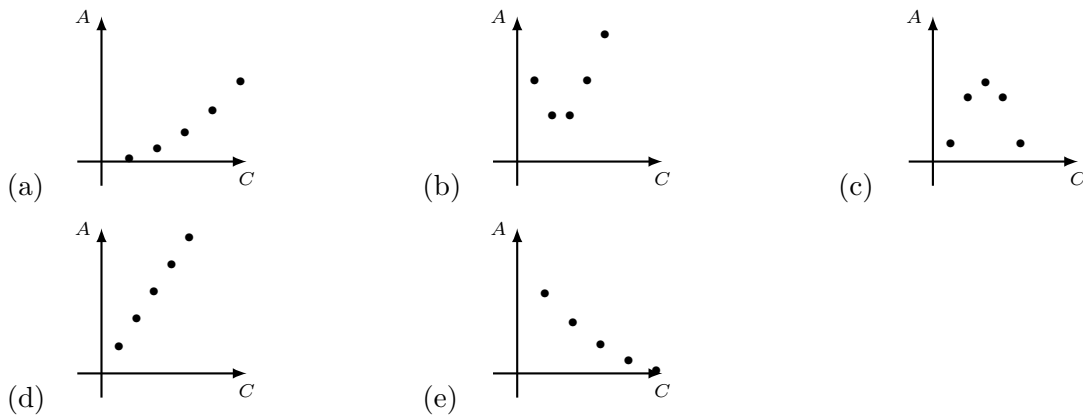
47. On the dart board, the outer circle has radius 6 and the inner circle has radius 3. Three radii divide each circle into three congruent regions, with point values shown in the figure. The probability that a dart hits a given region is proportional to the area of the region. When two darts hit this board, the score is the sum of the point values in the regions. What is the probability that the score is odd?



- (a) $\frac{17}{36}$ (b) $\frac{35}{72}$ (c) $\frac{1}{2}$ (d) $\frac{37}{72}$ (e) $\frac{19}{36}$

Answer: (b)

48. Suppose you have five circles with radii 1,2,3,4, and 5. Which of the graphs will plot the point (C, A) , where C is the circumference and A is the area of the five circles.



Answer: (a)

49. For any positive integer n , define $\langle n \rangle$ to be the sum of all positive factors of n . For example, $\langle 6 \rangle = 1 + 2 + 3 + 6 = 12$. Find $\langle \langle 11 \rangle \rangle$.

- (a) 13 (b) 20 (c) 24 (d) 28 (e) 30

Answer: (d)

50. A grid must have each of digits 1 through 4 once in each row and once in each column. What number will occupy the lower right-hand square in the grid?

1		2	
2	3		
			4

- (a) 1 (b) 2 (c) 3 (d) 4
 (e) Cannot be determined

Answer: (b)

51. There are four consecutive integers such that the sum of the cubes of the first three numbers equals the cube of the fourth number. Find the sum of the four numbers. *Answer: 18*
52. A point (x, y) is randomly chosen such that $0 \leq x \leq 1$ and $0 \leq y \leq 1$. What is the probability that $y \leq 2x$? *Answer: $\frac{3}{4}$*
53. Find the smallest three-digit number whose remainders are 2, 3, 4 and 5 when it is divided by 3, 4, 5 and 6, respectively. *Answer: 119*