|  |  |  |  |
| --- | --- | --- | --- |
| Angle Measure | Sine | Cosine | Tangent |
|  | 0.17 | 0.98 | 0.18 |
|  | 0.77 | 0.64 | 1.19 |
|  | 0.99 | 0.16 | 6.31 |

1. Suppose you have been assigned the job of measuring the height of the *Tower of Terror*. The ride looks really scary, so you decide to do the whole job from ground level. From a point 100 meters from the base of the tower, you find that you must look up at an angle of 81̊ to see the top of the tower. How high is the tower to the nearest foot if my eyesight is six feet off the ground?
   1. 631 feet
   2. 637 feet
   3. 644 feet
   4. 651 feet
   5. None of the Above
2. Your cat is trapped on a tree branch 8 feet off the ground. Your ladder is only 9 feet long. If you place the ladder’s tip on the branch, what angle will the ladder make with the ground?
   1. None of the Above
3. John and Brandi are shopping at a local sporting goods store for equipment. John notices that one of the items has an unusual numerical value for a weight. Brandi smartly reminds John that the reason the weight is a strange numerical value is because of the conversion from another unit of measurement. The units used on the weight were in Imperical units. Which of the following could be the weight?
   1. 66 pounds
   2. 66 kilograms
   3. 66 milliliters
   4. 66 pods
   5. None of the Above
4. A star is being sucked into a black hole. The star travels 25 km in the first second, 40 km in the second second and 55 km in the third second. Assuming the rate the star accelerates remains constant, how far does the star travel in the first ten minutes?
   1. 27105000 km
   2. 27105015 km
   3. 925 km
   4. 1050 km
   5. None of the Above
5. An LP record rotates at revolutions per minute. Find the angular velocity in of a point 2 centimeters from the center of the record.
   1. 40
   2. None of the Above
6. A salt shaker is sitting 5 cm from the center of a Lazy Susan. James spins the Lazy Susan through an angle of 120̊. What distance did the salt shaker travel?
   1. None of the Above
7. Deanna wants to construct a triangular planter with vertices A, B, and C where and and side a is also an integer value. What is the smallest possible length of side a that will still make her planter possible?
   1. 5
   2. 6
   3. 7
   4. 8
   5. None of the Above
8. A plane flies along a bearing of . The air is moving with a wind speed of along a bearing of . Find the plane’s resultant velocity vector.
   1. None of the Above
9. Using only the letters in the word HARRYPOTTER, in how many ways could you select an “R” and a vowel if two letters are selected at random?
   1. 9
   2. 12
   3. 240000
   4. 3326400
   5. None of the Above
10. Everett tears the labels off 8 cans of soup in his mom’s pantry. She knows that 3 cans are Vegetable soup and the rest are Chicken Noodle. What is the probability that she selects two cans of the same soup?
    1. None of the Above
11. The United State Government wants to build a new structure for the Department of Defense…. The Hexagon. If the Hexagon is a regular hexagon with apothem length of 200 feet, what is the area of each floor of the Hexagon?
    1. None of the Above
12. Find the vector 30% of the way from the head of to the tail of. The two given vectors are in standard position.
    1. None of the Above
13. You may have noticed that sometimes the length of a 3D vector is an integer when its components are integers as well. () Vectors of this form are called Pythagorean Quadruples. Which of the following is NOT a possible sum of
    1. 8
    2. 18
    3. 22
    4. 29
    5. None of the Above
14. Find the coordinates of a 90̊ counterclockwise rotation of the following coordinate pairs: . Which of the following is NOT one of the pairs?
    1. None of the Above
15. Scientists are measuring the rate of bacteria growth. The bacteria doubles every two hours. If there are 100 bacteria at the beginning of the process, how many bacteria are there after twelve hours?
    1. 3200
    2. 6400
    3. 12800
    4. 25600
    5. None of the Above
16. A furniture manufacturer wishes to make elliptical coffee table tops 50 inches wide and 30 inches long. What will the eccentricity be of the table tops?
    1. None of the Above
17. John is performing an experiment to determine the intelligence of mice. We use a grid from the Cartesian coordinate plane given the following conditions: . John sets up a maze on the plane where the mouse will travel from (0, 0) to (6, 8). The mouse has two choices to move at each stop: to the right one integer unit or up one integer unit. Find the total number of paths the mouse has to travel, given the mouse must go through the point (5, 3).
    1. 3003
    2. 1001
    3. 336
    4. 56
    5. None of the Above
18. Joe owns a large farm where he raises cows and chickens. Assume that every cow has the same amount of legs (4) and that every chicken has the same amount of legs (2). Joe owns 281 total animals which have 674 total legs. Find the positive difference between the number of cows and chickens.
    1. 144
    2. 169
    3. 196
    4. 225
    5. None of the Above
19. A figure skater wants to graph her path formed by limacon with an inner loop. Which of the following could be her path’s equation?
    1. None of the Above
20. Everett is arranging his monster trucks in rows of the following quantities of trucks: Row 1 (6), Row 2 (11), Row 3 (16), Row 4 (21), etc. How many trucks will he have lined up in total after he arranges his tenth row?
    1. 240
    2. 255
    3. 260
    4. 285
    5. None of the Above
21. A ball is thrown from the point at an angle of at an initial velocity of . Model the position of the ball over time (t) with parametric equations.
    1. None of the Above
22. The following are parametric equations for the path of a Ferris Wheel over time. Find the maximum height reached at the top of the ride.
    1. 14
    2. 20
    3. 34
    4. 54
    5. None of the Above
23. Polar coordinates are used in navigation because usually the direction of travel can be given as an angle and distance from a starting point. Aircraft use a modified version of the polar coordinates for navigation. In this system, the 0° ray is generally called heading 360, and the angles continue in a clockwise direction, rather than counterclockwise, as in the mathematical system. Heading 360 corresponds to magnetic north, while headings 90, 180, and 270 correspond to magnetic east, south, and west, respectively. Given the point in the Aircraft modified polar system, find the corresponding rectangular coordinate pair .
    1. None of the Above
24. A Cardioid Microphone is a uni-directional microphone, which indicates we only want to pick up sounds from “in front” (one direction). The resulting recording pattern is a cardioid. There is some “spill”, where sounds behind the microphone are also detected. Which of the following is a cardioid?
    1. None of the Above
25. Hillary wishes to invest her money and wait for it to double in ten years. If her money is compounded 8 times per year, what interest rate is required to make this happen?
    1. None of the Above
26. Bill and Ted are playing a game. Bill has three coins: a fair coin, a double headed coin and a weighted coin that has probability  of landing heads face up. The coins are placed in a bag. A coin is randomly selected from the bag and then the coin is tossed. If the coin lands heads, Bill wins $10. In order for the game to be fair, what must Ted win if the coin lands tails?
    1. $15
    2. $21
    3. $26
    4. $30
    5. None of the Above
27. A parabolic arch has a base 4 meters wide and a maximum height of 100 meters. How high (in meters) is the arch at a point on the ground 50 cm from the center of the base?
    1. 85.25
    2. 85.75
    3. 93.25
    4. 93.75
    5. None of the Above
28. The probability that a student at this convention will go to Magic Kingdom is 0.32, the probability that a student will not go to Universal Studios is 0.25, and the probability that they will not get to do either is 0.12. Please note that the probabilities are not independent/mutually exclusive. What is the probability that a student at this convention will get to go to Universal Studios, but not Magic Kingdom?
    1. 0.13
    2. 0.19
    3. 0.56
    4. 0.68
    5. None of the Above
29. Find the volume of the parallelepiped formed by the vectors: .
    1. 2
    2. 2.5
    3. 3
    4. 3.5
    5. None of the Above
30. My mom bought me a perfectly round, flat pizza pie with an area of 16. (She knows I LOVE pizza!!) The pizza is divided into twenty-four slices of exactly the same size and shape. Find the perimeter of one of these slices in feet.
    1. None of the Above