

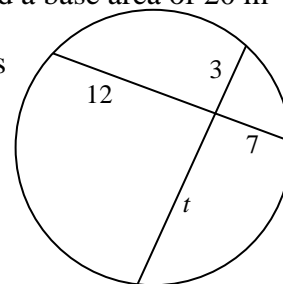
2013 Fall Startup Event
Thursday, September 26th, 2013

This test consists of 100 problems to be solved in 30 minutes. All answers must be exact, complete, and in simplest form. **To ensure consistent grading, if you get a decimal, mixed number, or ratio as any part of an answer, it should be expressed as a fraction unless otherwise specified in the problem.** A correct answer to a problem scores one point; a blank or incorrect answer to a problem scores no points. All answers must be written on the answer sheet in the boxes provided; work or answers written elsewhere will not be scored.

1. Evaluate: $1497 - 658$
2. Evaluate: 34×56
3. Evaluate: $3807 \div 81$
4. Evaluate **as a mixed number**: $5\frac{3}{4} + 2\frac{1}{6}$
5. What number is 65% of 340?
6. Evaluate: $-1 - 4(-5) - (-6)(-7)$
7. Evaluate: 3^6
8. Evaluate: $\frac{9!}{5! \times 4! \times 3!}$
9. Evaluate: $9 + 8 \times 7 - 5 \times 4^3$
10. Evaluate: $19^2 - 16^2$
11. What is the sum of the number of sides on a heptagon, the number of vertices on a cube, and the number of days in August?
12. When my secret number is decreased by fourteen and this result is divided by four, the final result is forty-four. What is my secret number?
13. What value(s) of b satisfy $6b - 5 = 37$?
14. What value(s) of c satisfy $3c + 4 = 5c + 6$?
15. What value(s) of d satisfy $2d^2 - 5d - 8 = 0$?
16. What ordered pair(s), in the form (f, g) , satisfy the equations $3f + 5g = 7$ and $f - 5g = 9$?
17. How many **minutes** would it take a car traveling 100 km/hr to go 30 kilometers?
18. If Brooks rides his bike 30 kilometers in 40 minutes, what is his average speed in km/hr?
19. If the sum of two numbers is 84 and their difference is 48, what is the smaller of the two numbers?

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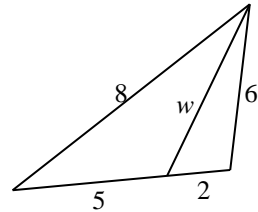
20. What is the slope of a line parallel to the line $3x - 5y = 8$?
21. What is the distance between the points $(4, -7)$ and $(-2, 2)$?
22. What are the coordinates, in the form (x, y) , of the point of intersection of the lines $y = 2x - 7$ and $3x - 4y = 13$?
23. What is the equation of the axis of symmetry of the parabola $x = 3y^2 - 36y + 1$?
24. What are the coordinates, in the form (x, y) , of the vertex of the parabola $y = x^2 + 6x + 5$?
25. What are the coordinates, in the form (x, y) , of the left-most x -intercept of the parabola $y = 2x^2 + 5x - 12$?
26. As you're watching dogs and their (human) owners at the dog park, you count 17 heads and 52 feet. How many dogs are in the park?
27. Katie is eight years older than her cousin Isaac, and in two years she will be three times as old as him. In how many years will Katie be twice as old as Isaac?
28. Simplify by expanding and combining like terms: $(3q + 2)(q - 4)$
29. If $r(s) = 5s(s + 1)$, evaluate $r(-3)$.
30. What is the perimeter, in centimeters, of an equilateral triangle with sides measuring 17 cm each?
31. What is the area, in square centimeters, of an isosceles triangle with sides measuring 18 cm and 41 cm?
32. What is the name for a triangle with at least one angle smaller than 90° and at least one angle larger than 90° ?
33. What is the area, in square meters, of a circle with a radius measuring 8 m?
34. What is the perimeter, in centimeters, of a nonagon with sides measuring 13 cm each?
35. What is the circumference, in centimeters, of a circle with an area of $289\pi \text{ cm}^2$?
36. Two similar quadrilaterals have areas of 14 m^2 and 56 m^2 . If one of the quadrilaterals has a perimeter of 16 m, what is the perimeter, in meters, of the other quadrilateral?
37. What is the height, in meters, of a pyramid with a volume of 96 m^3 and a base area of 20 m^2 ?
38. In the figure to the right, segment lengths are given in meters. What is the value of t ?



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39. Two secant line segments from point U to circle V meet at an angle of 41° . If the smaller of the two arcs they subtend measures 14° , what is the measure, in degrees, of the larger subtended arc?

40. In the figure to the right, segment lengths are given in centimeters. What is the value of w ?



41. When two lines intersect, the sum of one pair of vertical angles is 48° . What is the sum of the measures of the other pair of vertical angles, in degrees?

42. A circle is tangent to a chord of a larger circle with the same center. If the chord is 56 m in length, what is the area, in square meters, of the region between the two circles?

43. How many diagonals can be drawn in a convex heptagon?

44. What is the largest possible area, in square centimeters, of a right triangle with a hypotenuse measuring 10 cm?

45. What is the largest number of regions into which six lines can divide a plane?

46. What is the positive difference, in degrees, between the measures of the supplement and complement of angle G ?

47. When the vertices of a regular n -gon are labeled A, B, C, ..., R, which other vertex does a line through vertex D and the center also pass through?

48. What are the coordinates, in the form (x, y) , of the center of the conic section with equation $3x^2 - 2y^2 + 12x + 20y = 38$?

49. What is the name for the locus of all points that are five times as far from a given line as they are from a given point?

50. Evaluate: $\log_8 4$

51. What is the smallest integer value of h satisfying $4 + 3 \cdot 2^h > 1098$?

52. What value(s) of j satisfy $9^j - 30 \cdot 3^j + 81 = 0$?

53. What is the domain of the function $k(m) = \frac{\sqrt{49-m^2}}{2m-14}$, if the domain and range are both subsets of the real numbers?

54. If n is directly proportional to p , and $n = 72$ when $p = 27$, what value of p will make $n = 216$?

55. Jaytenium has a half-life of ten minutes. To the nearest integer, what percentage of a sample will remain after an hour?

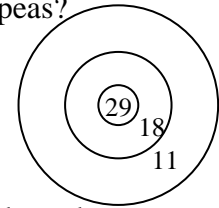
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56. When $(2q + 3)^4$ is expanded and like terms are combined, what is the coefficient of the q^2 term?
57. What is the product of the five complex fifth-roots of 32?
58. If $\log_r 2 = s$, express $\log_2(4r)$ in terms of s .
59. How many prime numbers are between 80 and 100?
60. Express the base-5 number 243_5 as a base-10 number.
61. Express the base-10 number 243_{10} as a base-6 number.
62. Express the prime factorization of 108 in exponential form.
63. How many positive integers are factors of 140?
64. What is the sum of the positive integer factors of 300?
65. How many positive four-digit integers have a hundreds-digit that is twice their ones-digit?
66. What is the product of the smallest positive four-digit palindrome and the largest positive two-digit palindrome?
67. What is the sixth term of a geometric sequence with first term 7 and common ratio 2?
68. What is the missing term of the sequence 9, 12, 20, 35, __, 94, 142, 205?
69. What is the third term of a harmonic sequence with first term 7 and second term 5?
70. What is the 71st term of an arithmetic sequence with first term 17 and tenth term 44?
71. What is the sum of the terms of an infinite geometric sequence with second term 20 and common ratio $\frac{1}{3}$?
72. What is the missing term of the sequence 3, 7, 10, 17, __, 44, 71, 115, 186?
73. What is the sum of the twelve smallest positive perfect squares?
74. What is the sum of the positive perfect cubes less than 1000?
75. When four coins are flipped, what is the probability that exactly three of them are heads?
76. When two standard six-sided dice are rolled, what is the probability that the sum of the numbers on their upper faces is a multiple of four?
77. In Teacher Gloria's class, three students wear all red, and the other four students wear all yellow. If the students are asked to line up so that students wearing the same color all stand together, in how many ways can they line up?

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78. Of the thirty members of the Burien Garden Group, fourteen grew tomatoes, twenty-six grew peas, and three grew neither. How many members grew both tomatoes and peas?

79. The dartboard to the right has three zones with radii of 2 cm, 5 cm, and 9 cm, with point values as shown. If my dart hit the dartboard, what is the probability that I got less than 23 points?



80. A bag contains three two-dollar tokens and five six-dollar tokens. If you grab a token without looking, what is the expected value of your grab, as a decimal to the nearest hundredth of a dollar (cent)?

81. You have five buttons you plan to distribute into three currently indistinguishable socks. How many distinguishable distributions are there, if some socks may remain empty?

82. What is the cofactor of the 4 in the matrix $\begin{bmatrix} 1 & 2 & 3 \\ 4 & 5 & 6 \\ 7 & 8 & 9 \end{bmatrix}$?

83. What is the area of the triangle with vertices at the points (1,0), (-1,3), and (-2,-3)?

84. What is the median of the data set {9, 1, 8, 3, 7, 6, 6, 1, 5}?

85. What is the mean of the data set {2, 8, 4, 5, 6, 1}?

86. In a five-element set of integer test scores between 0 and 100 inclusive, the unique mode is 67 and the range is 81. What is the minimum possible value of the median?

87. If T is the set of all positive three-digit multiples of ten and U is the set of all multiples of 8, how many elements are in the set $T \cap U'$?

88. How many subsets of the multiples of three less than thirty contain exactly three even numbers?

89. Using the numerals 6, 8, and 9 exactly once each and the operators $+$, $-$, \times , and \div (as well as $()$) as much or as little as you like, write an expression that evaluates to 12.

90. What is the tangent of the smallest angle in a triangle with sides measuring 3m, 4m, and 5m?

91. Evaluate: $\cos(150^\circ)$

92. If $\sin A = \frac{1}{3}$ and $\sin B = \frac{3}{5}$, evaluate $\cos(A + B)$.

93. What is the area, in square meters, of a triangle with sides measuring 7m, 12m, and 13m?

94. What is the period, in radians, of the function $c(d) = 4 \sin(5d + 6\pi) + 7$?

95. Evaluate in radians: $\sin^{-1}\left(-\frac{1}{2}\right)$

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96. Evaluate: $\lim_{\theta \rightarrow 2\pi} \frac{\sin(3\theta)}{\theta - 2\pi}$

97. Evaluate: $\lim_{f \rightarrow 3} \frac{2f^3 - 2 \cdot 3^3}{f - 3}$

98. Evaluate: $\int_1^2 12x(x^2 + 1)^2 dx$

99. What is the volume of the solid created when the region in the first quadrant of the Cartesian Plane satisfying $x + 2y < 6$ is rotated about the x-axis?

100. Express in interval notation the values of x for which the graph of $y = 2x^2 - \frac{1}{12}x^4$ is concave up.