

Advanced Mathematics Video Problems

Pre-Algebra and Elementary Algebra

Fractions

1. Anne paints fences as her summer job. This week, she finished painting 2 of 5 white fences and 1 of 7 green fences. What is the fraction of white and green fences that Anne did not finish painting this week?
 - A. $\frac{1}{4}$
 - B. $\frac{1}{2}$
 - C. $\frac{3}{5}$
 - D. $\frac{3}{4}$
 - E. $\frac{6}{7}$

Percent Word Problems

2. After 75% of a pizza has been eaten, 6 pieces remain. Assuming the pieces were of equal size, how many pieces did the pizza originally have?
 - F. 24
 - G. 20
 - H. 18
 - J. 10
 - K. 8
3. Which of the following represents $\frac{1}{100}$ of 10%?
 - A. 100
 - B. 10
 - C. .10
 - D. .001
 - E. .0001

Averages

4. A group of n musicians practiced an average of x hours per week. One musician discovered that her practice time was recorded incorrectly and should have been t hours longer. Compared to the uncorrected average, the new practice time average for the group of musicians will be:
 - F. the same
 - G. t hours longer
 - H. n hours longer
 - J. $\frac{n}{t}$ hours longer
 - K. $\frac{t}{n}$ hours longer

Key Facts

5. Pamela needs a test average of at least 84 to make a “B” in her biology class. If she has test scores of 80, 73, 92, and 84 on 4 of her 5 tests, what is the lowest score she can make on her 5th test to get a “B” in biology?

- A. 86
- B. 89
- C. 91
- D. 92
- E. 94

Constructing Formulae

6. A store is having a special promotion and is tripling the value of “cents-off” coupons. Let S be the price of a given box of So-Clean laundry detergent, and let B represent the size of the box in ounces. If a customer has a 30 cent coupon for any size box of So-Clean Laundry Detergent, then which of the following formulas determines the price per ounce of the laundry detergent, in cents, after the discount from the triple coupon?

- F. $\frac{S}{B} - 30$
- G. $\frac{S - 30}{B}$
- H. $\frac{3(S - 30)}{B}$
- J. $\frac{S - 3(30)}{B}$
- K. $\frac{S}{B - 3(30)}$

7. Let \odot be an operation defined on the real numbers by $c \odot d = \frac{(c + d)}{3}$. Which of the following is (are) true for all real numbers c , d , and f ?

- I. $c \odot d = d \odot c$
- II. $(c \odot d) \odot f = c \odot (d \odot f)$
- III. $0 \odot f = 0$

- A. I only
- B. II only
- C. III only
- D. I and II only
- E. I, II, and III only

Key Facts

*Solving for one variable in terms
of the other variables*

8. In 4 games, Kate scored u points in the first game, $2u$ points in the second game, and $u + 2$ points in the last two games. Which of the following expressions best represents the total number of points Kate scored in all 4 games?
- F. $4u + 2$
 - G. $4u + 2$
 - H. $4u + 4$
 - J. $5u + 3$
 - K. $5u + 4$
9. If $x^2 - 4dx = 12d^2$, what are the 2 solutions for x in terms of d ?
- A. $-8d$ and $4d$
 - B. $-4d$ and $3d$
 - C. $-3d$ and $2d$
 - D. $-2d$ and $6d$
 - E. $-2d$ and $3d$

Factoring

10. For all x , which of the following is a factor of $8x^2 + 2x - 3 = 0$?
- F. $x - 3$
 - G. $2x - 1$
 - H. $2x - 3$
 - J. $4x - 3$
 - K. $4x - 1$
11. If the lengths of adjacent sides of a rectangular field are represented by $3x - 2$ and $2x^2 + 4$ units, respectively, for some value of x , then which of the following expressions represents the area, in square units, of the field?
- A. $2x^2 + 12x - 8$
 - B. $6x^2 + 8x - 8$
 - C. $6x^3 - 4x^2 + 12x - 8$
 - D. $6x^3 - 4x^2 + 12x + 8$
 - E. $6x^3 - 12x^2 + 4x - 8$
12. If $8x^2 - b = (bx + 1)(4x - 2)$, what is the value of b ?
- F. -2
 - G. -1
 - H. 2
 - J. 4
 - K. 8

Key Facts

Solving Equations

13. What is the smallest integer, x , satisfying the condition that $x - \sqrt{3}$ is positive?

- A. 1
- B. 2
- C. 3
- D. 4
- E. 5

14. The equation $\frac{1}{2}x - \frac{2}{3} = \frac{1}{2} + \frac{2}{3}x$ has only one solution. What is this solution?

- F. -7
- G. -3
- H. 1
- J. 2
- K. 3

15. The quadratic equation $6x^2 = 27x$ can be solved by factoring. Which of the following states the complete solution?

- A. $x = -\frac{9}{2}$ or $x = 3$
- B. $x = -\frac{3}{2}$ or $x = \frac{9}{2}$
- C. $x = 0$ or $x = \frac{9}{2}$
- D. $x = 0$ or $x = 1$
- E. $x = 1$ or $x = -1$

16. If the equation $x^2 + mx + 2 = 0$ has 2 real solutions, both of which are negative integers, which of the following lists all possible values of m ?

- F. -2
- G. -1
- H. 3
- J. -3
- K. ± 3

Radicals and Square Roots

17. $(2 + 3\sqrt{3})(4 - 2\sqrt{3}) = ?$

- A. $-10 + 8\sqrt{3}$
- B. $-10 + 12\sqrt{3}$
- C. $-10 - 4\sqrt{3}$
- D. $8 + 8\sqrt{3}$
- E. $24 + 8\sqrt{3}$

Key Facts

Exponents and Powers of 10

18. How many zeros are there in the integer representation of the product of 4 billion and 5 million?
- F. 14
 - G. 15
 - H. 16
 - J. 17
 - K. 18

Formula Substitution

19. If the monthly mortgage payment, D dollars, on a house that costs H dollars is given by the formula $D = H/200 - 0.0005H + 60$, what is the monthly payment, to the nearest dollar, on a house that costs \$100,000?
- A. 404
 - B. 410
 - C. 460
 - D. 510
 - E. 570
20. A given rectangle is represented by length (l) and width (w). Tripling each of the dimensions (l and w) will increase the original area by what factor?
- F. 3
 - G. 6
 - H. 9
 - J. 18
 - K. 27

Division by Zero

21. The expression $\frac{a-b}{b}$ has the value of 0 if and only if:
- A. $a = 0$ and $b = 0$
 - B. $a \neq 0$ and $b \neq 0$
 - C. $a - b = 0$ and $b \neq 0$
 - D. $a - b \neq 0$ and $b = 0$
 - E. $a - b \neq 0$ and $b \neq 0$
22. For which real values of n is $\frac{3n}{3^{2n-4}}$ defined?
- F. All real numbers
 - G. All real numbers except -2
 - H. All real numbers except 0
 - J. All real numbers except $1/2$
 - K. All real numbers except 2

Probability and Combinations

23. David has 3 sweaters, 2 pairs of pants, and 3 pairs of shoes that go together well in any combination. How many different outfits can David put together consisting of 1 sweater, 1 pair of pants, and 1 pair of shoes?

A. 5
B. 6
C. 8
D. 12
E. 18

24. Mark placed 6 yellow balls, 4 green balls, and 2 blue balls into a container. Mark then began to draw balls from the container at random. The first ball that Mark drew was yellow. The second ball that he drew was also yellow. These two yellow balls were not replaced in the container. What is the probability that the third ball that Mark draws will be yellow?

F. $1/12$
G. $1/5$
H. $1/3$
J. $2/5$
K. $1/2$

Factors, Prime Factors, Multiples

25. What is the largest possible product that can be formed by multiplying 3 different numbers chosen from -9, -2, 1, 3, and 5?

A. 15
B. 90
C. 135
D. 405
E. 729

26. Both L and M are positive integers, and the smallest positive integer that is divisible by both L and M is 45. The greatest common factor of L and M is 3. If $L = 15$, then $M = ?$

F. 3
G. 5
H. 9
J. 15
K. 25

Key Facts

27. If $(r - s)^2 = 9$ and $rs = 18$, then $r^2 + s^2 = ?$

- A. 175
- B. 162
- C. 121
- D. 50
- E. 45

28. Which of the following calculations will yield an even integer for any positive integer g ?

- F. g^2
- G. $2g^2$
- H. $3g^2$
- J. $2g^2 + 1$
- K. $3g^2 + 1$

29. If d is a positive integer that divides both 68 and 85, but divides neither 10 nor 15, what would you get when you add the digits in d ?

- A. 1
- B. 2
- C. 5
- D. 6
- E. 8

Distance

30. Tony drove 400 miles at 55 miles per hour. How long did Tony's drive take to the nearest tenth of an hour?

- F. 5.3
- G. 6.2
- H. 6.8
- J. 7.2
- K. 7.3

31. Katie can walk 5 miles in t minutes. At that pace, how many minutes would it take her to walk 9 miles?

- A. $45t$
- B. $5/9t$
- C. $9/5t$
- D. $5t/9$
- E. $9t/5$

Key Facts

32. $\sqrt{x-7}$ is a real number if and only if :

- F. $x \geq 7$
- G. $0 < x < 7$
- H. $x = 0$
- J. $-7 < x < 0$
- K. $x < -7$

33. What is the smallest number greater than 1 that, when divided by 2, 3, 4, or 5, leaves a remainder of 1 in each case?

- A. 7
- B. 21
- C. 31
- D. 61
- E. 121

Intermediate Algebra and Coordinate Geometry

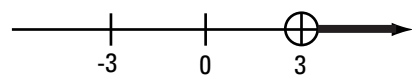
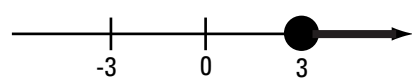
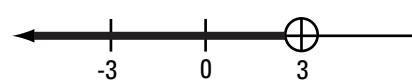
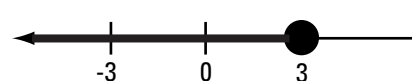
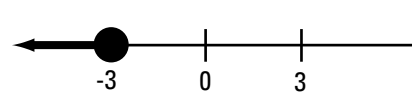
Absolute Value

34. Which of the following expresses all and only the values of x that satisfy $|4x + 2| < 1$?

- F. $-4 < x < 4$
- G. $-4 < x < 3/4$
- H. $-1/4 < x < 3/4$
- J. $-3/4 < x < -1/4$
- K. $-3/4 < x < 3/4$

Inequalities

35. Which of the following is a graph of $3 \leq x$?

- A.  A number line with tick marks at -3, 0, and 3. An open circle is at 3, and a ray extends to the right from 3.
- B.  A number line with tick marks at -3, 0, and 3. A closed circle is at 3, and a ray extends to the right from 3.
- C.  A number line with tick marks at -3, 0, and 3. An open circle is at 3, and a ray extends to the left from 3.
- D.  A number line with tick marks at -3, 0, and 3. A closed circle is at 3, and a ray extends to the left from 3.
- E.  A number line with tick marks at -3, 0, and 3. A closed circle is at -3, and a ray extends to the left from -3.

Key Facts

36. Given that $|2x + 3| \geq 11$, what is the largest set of negative numbers included in the solution set of this inequality?

- F. All negative numbers less than or equal to -4
- G. All negative numbers less than or equal to -6
- H. All negative numbers less than or equal to -7
- J. All negative numbers less than or equal to -11
- K. No negative numbers satisfy this inequality

Negative and Zero Exponents

37. If $c^{2c-2} = 9^{d-1}$ and $c = 3$, what is the value of d ?

- A. 7
- B. 6
- C. 4
- D. 3
- E. 2

Radicals

38. If $m = 7 + \sqrt{2}$ and $n = 7 - \sqrt{2}$, which of the following numbers must be rational?

- I. mn
 - II. $m + n$
 - III. m/n
-
- F. I only
 - G. II only
 - H. III only
 - J. I and II only
 - K. I, II, and III only

Equation of a Straight Line

39. What is the y -intercept of the line determined by the equation $5x + 2y + 4 = 0$?

- A. $-5/2$
- B. -2
- C. -1
- D. 2
- E. $5/2$

Key Facts

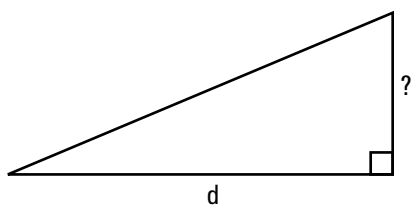
Key Facts

40. Which of the following is the slope-intercept form of the equation of the line that is parallel to the line $y = (1/2)x + 3$ in the standard (x,y) coordinate plane and that also contains the point $(0,5)$?

- F. $y = 2x + 10$
- G. $y = 1/2 - 5$
- H. $y = (1/2)x + 5$
- J. $y = (-1/2)x + 10$
- K. $y = -2x - 5$

41. As shown in the figure below, the base of a ramp is d feet long. The slope of the ramp (rise divided by run) is c , where $c > 0$. Which of the following expressions gives the height of the ramp in feet?

- A. cd
- B. c/d
- C. d/c
- D. $c^2 - d^2$
- E. $\sqrt{c^2 - d^2}$



Distance between two points

42. A map is laid out in the standard (x,y) coordinate plane. How long, in units, is a train's path on the map as the train travels along a straight track from Town A located at $(16, 7)$ to Town B located at $(10, 11)$?

- F. $\sqrt{241}$
- G. $\sqrt{209}$
- H. $\sqrt{91}$
- J. 7
- K. $2\sqrt{13}$

Parabolas, circles, ellipses

43. What is the greatest y -coordinate among all points on the circle $(x + 5)^2 + (y - 6)^2 = 4$?

- A. -12
- B. -8
- C. -4
- D. 4
- E. 8

44. Which of the following is a simplified version of $\frac{(2x+1)}{x} - \frac{x+3}{3x}$, valid whenever $x \neq 0$?
- F. $6x + 3$
 G. $5x + 3$
 H. $5x - 3$
 J. $5x/3$
 K. $5/3$

45. For all positive c and all positive d , $\frac{\frac{1}{c} + \frac{1}{d}}{\frac{1}{c} - \frac{1}{d}} = ?$
- A. -1
 B. $\frac{d+c}{d-c}$
 C. $\frac{d-c}{d+c}$
 D. $\frac{c-d}{c+d}$
 E. $\frac{(c-d)(c+d)}{c^2d^2}$

Ratios

46. A certain company maintains computers in constant proportion to the number of employees. Last year, the company employed 300 people and had 240 computers. This year the company added 50 new employees. To keep a constant proportion, how many new computers should the company purchase?
- F. 40
 G. 50
 H. 60
 J. 70
 K. 280
47. In a certain elementary school, the ratio of left-handed students to right-handed students is 2 to 9. The school has 440 students. How many students are left-handed?
- A. 36
 B. 40
 C. 80
 D. 220
 E. 360

Key Facts

48. For what values of x is $x^2 - 2x + 1$ positive?

- F. $x < -1$
- G. $x > -1$
- H. $x > 1$
- J. $x < 1$
- K. All real numbers except $x = 1$

49. If $y = 9 - (x + 2)^2$, for what value of x will y have its maximum value?

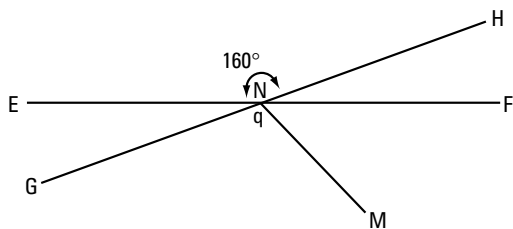
- A. -4
- B. -3
- C. -2
- D. -1
- E. 0

Plane Geometry and Trigonometry

Straight Lines

50. Lines EF and GH intersect at point N . Line NM bisects angle GNE . What is the degree measure of angle q ?

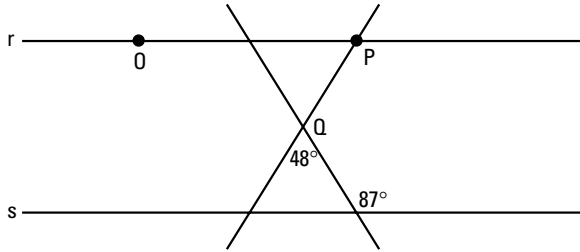
- F. 80
- G. 90
- H. 110
- J. 130
- K. 160



Parallel Lines

51. Two transversals intersect at point Q, a point between two parallel lines, r and s. The measures of angles are as marked on the figure below. What is the measure of angle OPQ?

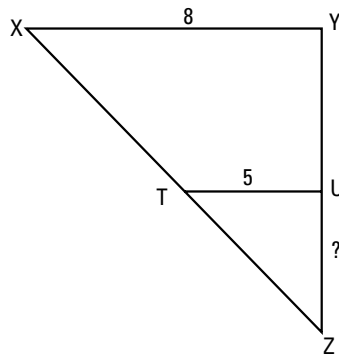
- A. 28
- B. 45
- C. 47
- D. 63
- E. 73



Triangles

52. In triangle XYZ shown below, XY is parallel to TU, $YZ = 12$, and other lengths, in units, are as marked. How many units long is UZ?

- F. $4 \frac{3}{4}$
- G. 5
- H. $6 \frac{5}{8}$
- J. $7 \frac{1}{2}$
- K. $8 \frac{3}{4}$



53. The base of an isosceles triangle is 6 units long and each of the congruent sides is 5 units long. What is the area of the triangle, in square units?

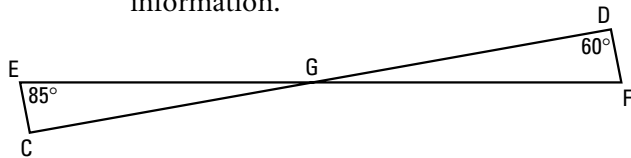
- A. 11
- B. 12
- C. 18
- D. 30
- E. 35

Key Facts

Key Facts

54. In the figure below, CD and EF intersect at G. The measure of angle CEG is 85 degrees and the measure of angle GDF is 60 degrees. What is the measure of angle EGC?

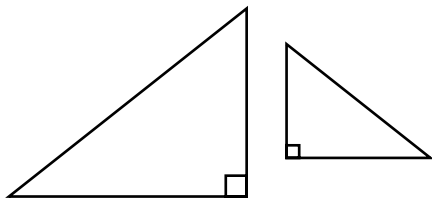
- F. 30
- G. 35
- H. 45
- J. 60
- K. Cannot be determined from the given information.



Right Triangles

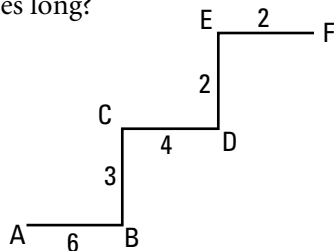
55. Two 30-60-90 degree triangles are shown below. The hypotenuse of the larger triangle is 24 inches long. If the perimeter of the larger triangle is 4 times that of the smaller triangle, how many inches long is the shortest of the six sides?

- A. 12
- B. 7
- C. 5
- D. 4
- E. 3



56. In the figure below, all angles are right angles, and distances are marked, in inches. A straight line drawn from point A to point F would be how many inches long?

- F. 12
- G. 13
- H. 15
- J. 17
- K. 19



57. One side of a right isosceles triangle is $8\sqrt{2}$ centimeters long. Which of the following could be the lengths of the other 2 sides, in centimeters?

- A. $8\sqrt{3}$ and 8
- B. $8\sqrt{2}$ and $16\sqrt{2}$
- C. $8\sqrt{2}$ and 8
- D. $8\sqrt{2}$ and 16
- E. $8\sqrt{2}$ and $8\sqrt{2}$

Rectangles and squares

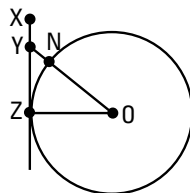
58. In her elementary school class, Tammy was working on a craft project with construction paper. She wanted to cover an 8-inch-by-12-inch rectangular piece of blue paper with 2-inch by 2-inch red squares. How many red squares does Tammy need to cover the blue piece of paper with one layer of red construction paper squares?
- F. 4
G. 10
H. 20
J. 24
K. 32
59. A square has an area of 32.7 square centimeters. If p is the side length of the square in centimeters, then p must lie between which 2 consecutive integers?

- A. $5 < p < 6$
B. $8 < p < 9$
C. $15 < p < 16$
D. $16 < p < 17$
E. $32 < p < 33$

Circles

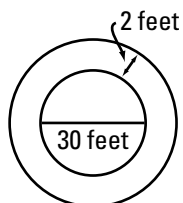
60. As depicted in the figure below, XZ is tangent to the circle at point Z . The measure of angle XYO is 130 degrees. If the center of the circle is at O , what is the degree measure of arc NZ ?

- F. 90
G. 75
H. 55
J. 50
K. 40



61. A circular garden has a diameter of 30 feet and has a brick walkway around it that is 2 feet wide, as is depicted below. What is the area of the walkway in square feet?

- A. 742π
B. 256π
C. 124π
D. 64π
E. 31π

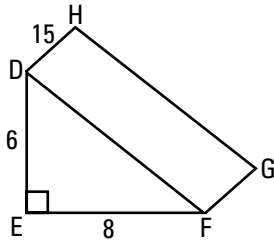


Key Facts

Triangles plus Rectangle or Square

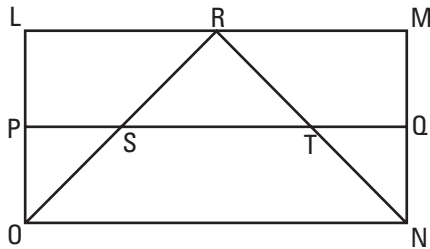
62. In the diagram below, for right triangle DEF, DE is 6 units long and EF is 8 units long. What is the area, in square units, of rectangle DFHG?

- F. 50
G. 115
H. 125
J. 135
K. 150



63. In the figure below, the rectangle PQNO is contained in square LMNO. If isosceles triangle RNO divides PQ into 3 equal segments, what is the ratio of the widths of these rectangles (that is, PO to LO)?

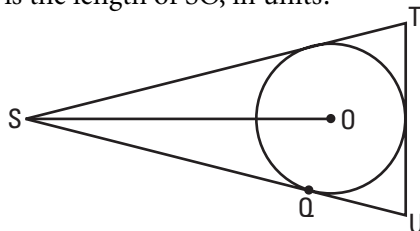
- A. 1:1
B. 1:2
C. 1:3
D. 2:3
E. 2:5



Triangle plus Circle

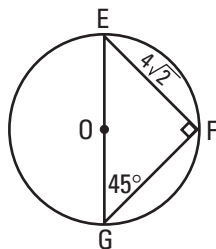
64. The figure below shows a circle, with center O, inscribed in triangle STU, and Q is a point of tangency of the circle with line SU. If SQ is 5 units long and the radius of the circle is 2 inches in length, what is the length of SO, in units?

- F. $7\sqrt{23}$
G. $6\sqrt{7}$
H. 6
J. $\sqrt{29}$
K. 4



65. Triangle EFG is depicted within the circle below. The center of the circle is point O. Angle measures and side length are given in the figure. What is the area of the circle, in square units?

- A. 4π
B. 8π
C. 16π
D. 32π
E. 64π

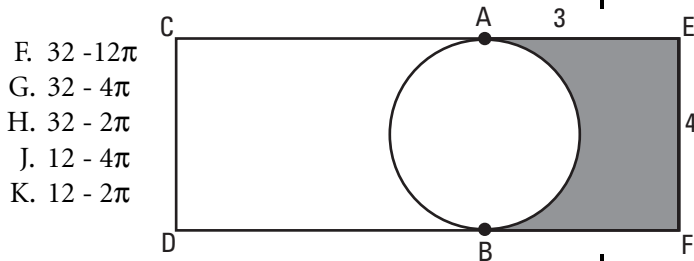


Key Facts

Circle plus Rectangle or Square

Key Facts

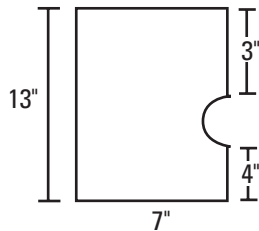
66. The circle below is tangent to the rectangle at points A and B. $DF = 8$ and other measurements are shown in units. What is the area of the shaded region, in square units?



- F. $32 - 12\pi$
- G. $32 - 4\pi$
- H. $32 - 2\pi$
- J. $12 - 4\pi$
- K. $12 - 2\pi$

67. The figure below shows a semicircle cut from a rectangle. Distances are given in inches. What is the area of the figure, in inches?

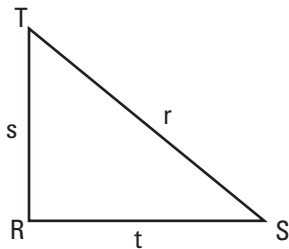
- A. $91 - 4.5\pi$
- B. $91 - 9\pi$
- C. $49 - 4.5\pi$
- D. $49 - 18\pi$
- E. $20 - 9\pi$



Trigonometry

68. In the figure below, what is the sine of angle T?

- F. t/r
- G. t/s
- H. r/t
- J. r/s
- K. s/t



69. If $0^\circ \leq x \leq 90^\circ$ and $\cos x = 12/13$, then $\tan x = ?$

- A. $5/13$
- B. $5/12$
- C. $13/12$
- D. $12/5$
- E. $13/5$

70. For values of b where $\sin b$, $\cos b$, and $\tan b$ are all defined, $\frac{(\cos b)(\tan b)}{\sin b} = ?$

- F. -1
- G. 1
- H. $\tan^2 b$
- J. $\cos^2 b$
- K. $\sin^2 b$