Academic Excellence
in Mathematics and
Science through
Competition

T M S C A   M I D D L E   S C H O O L

C A L C U L A T O R

S T A T E   T E S T ©

A P R I L 2 1 , 2 0 1 8

GENERAL DIRECTIONS

I. About this test:
   A. You will be given 30 minutes to take this test.
   B. There are 80 problems on this test.
II. How to write the answers:
   A. For all problems except stated problem as noted below write three significant digits.
      1. Examples (* means correct, but not recommended)
         Correct: 12.3, 123, 123.*, 1.23x10*, 1.23x10^0*, 1.23x10^1, 1.23x10^{01}, .0190, 1.90x10^{-2}
         Incorrect: 12.30, 123.0, 1.23(10)^2, 1.23$^.$10^2, 1.230x10^2, 1.23*10^2, 0.19, 1.9x10^{-2}, 19.0x10^{-3}, 1.90E-02
      2. Plus or minus one digit error in the third significant digit is permitted.
   B. For stated problems:
      1. Except for integer, dollar sign, and significant digit problems, as detailed below, answers to stated problems should be written with three significant digits.
      2. Integer problems are indicated by (integer) in the answer blank. Integer problems answers must be exact, no plus or minus one digit, no decimal point or scientific notation.
      3. Dollar sign ($) problems should be answered to the exact cent, but plus or minus one cent error is permitted. The decimal point and cents are required for exact dollar answers.
   III. Some symbols used on the test.
      A. Angle measure: rad means radians; deg means degrees.
      B. Inverse trigonometric functions: arcsin for inverse sine, etc.
      C. Special numbers: π for 3.14159 .   .   . ; e for 2.71828.
      D. Logarithms: Log means common (base 10); Ln means natural (base e).
   IV. Scoring:
      A. All problems answered correctly are worth FIVE points. FOUR points will be deducted for all problems answered incorrectly or skipped before the last problem attempted.

2017-2018 TMSCA Middle School Calculator State Meet

1.   1310 + 2670 --- 1=_____

2.   26 + 20 + 17 --- 2=_____

3.   587 + 2280 + 1010 -- 3=_____

4.   18 − 16 + π − 10 -- 4=_____

5.   468 − 1010 − 1270 − 1030 ------------------------------- 5=_____

6.   179 + 158 − 134 − 175 − 182 ---------------------------- 6=_____

7.   (1.72 + 0.783 − 1.18) − (0.576 + 1.37) ------------------ 7=_____

8.   −0.349 − 0.777 + 0.533 − 0.722 − 0.883 ---------------- 8=_____

9.   22.4 x 75 x 181 --- 9=_____

10.   294 x 2520 x 126 x 754 ---------------------------------- 10=_____

11. A circle has an area of 37π square inches. Calculate the
    circumference of the circle.   ------------------------------------ 11=_____in.

12. Calculate the value of the reciprocal of the cubed root of the
    natural log of 57912.   --- 12=_____

13. Calculate the number of distinct diagonals a polygon with 222
    sides has. --- 13=_____INT.

14. $(28/58)[160 - 143]$ -------------------------------------- 14=_____

15. $(76)[166 \times 132 \times 36]$ ------------------------------- 15=_____

16. $\left[\dfrac{177}{147}\right][(210/184) - 0.268]$ ------------------------------- 16=_____

17. $\left[\dfrac{244}{128}\right][(278/348) + 0.622]$ ------------------------------- 17=_____

18. $\dfrac{[298/(262)]/0.0933}{(3.42 \times 3.55)(0.0143)}$ ------------------------------- 18=_____

19. $\left[\dfrac{101/218}{100/241}\right]\{2.76 + 0.628 - 0.998\}$ --------------------- 19=_____

20. $(12.2)[87/72 \times 52/74] - \pi$ ------------------------------- 20=_____

21. $\dfrac{(\pi)(36/23)(16/43)}{314}$ ------------------------------- 21=_____

22. $\dfrac{(587 \times 1300)/869}{(859 \times 12.3) + 4370}$ ------------------------------- 22=_____

23. $\left[\dfrac{1150 + 1280}{943 - 972}\right]\left[\dfrac{1070}{1250}\right]$ ------------------------------- 23=_____

24. Calculate the slope of the line perpendicular to
                $(3/7)x - (4/5)y = 7/11$ ---------------------- 24=_____

25. Calculate the value of seven-eighths of thirty-one percent of a
    perfect score on this test. ---------------------------------- 25=_____

26. Calculate the product of the arithmetic mean, the geometric mean
    and the harmonic mean of the first four prime numbers. --------- 26=_____

27. $(64.6)\big[(3.92/1.48)(126/369)\big]$ -------------------------- 27=_____

28. $(11.3)\big[(0.00201/0.00513)(0.00532 + 0.00437)\big]$ --------- 28=_____

29. $\dfrac{(31.8 + 62.5)(0.00644 + 0.009)}{(1.80 \times 10^{11})}$ ------------------------- 29=_____

30. $\dfrac{1}{-0.0152} + \dfrac{1}{(0.0619 - 0.074)}$ ---------------------------- 30=_____

31. $(3.68)\big[(1.12 \times 10^7) - (2.66 \times 10^6)\big]$ -------------------- 31=_____
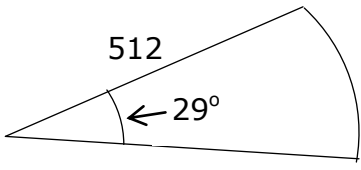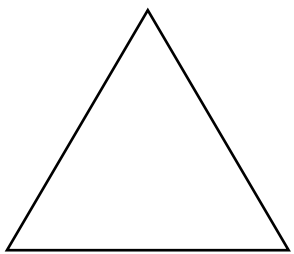
32. $(755)\left[\dfrac{1.22}{(3.67 \times 10^8)}\right]$ ------------------------------------- 32=_____

33. $\dfrac{1}{39.6} - \dfrac{1}{148} + \dfrac{1}{195}$ ----------------------------------- 33=_____

34. $\left[\dfrac{1/3590}{1/4890}\right][1.94 \times 10^6]$ ----------------------------------- 34=_____

35. Calculate the value of 523421 Base 7 in base 10. ---------------- 35=_____INT.

36. Calculate $(-721)(-2121)^{718}$. ------------------------------------- 36=_____

CIRCLE SECTOR	EQUILATERAL TRIANGLE
512 $\leftarrow 29°$ Perimeter = ?	Area = 2713 Perimeter = ?
37=_____	38=_____

39. $\left[\dfrac{5.68}{1090}\right](76.1 + 99.5)^4$ ------------------------------------ 39=_____

40. $\sqrt{\dfrac{2690 + 723}{235 - 159}}$ -- 40=_____

41. $(140 + 75.5)^2(51.8 + 28.5)^2$ ---------------------------- 41=_____

42. $\sqrt{(55.8/118) + 0.203 - 0.19}$ ---------------------------- 42=_____

43. $(1/(6.93\text{x}10^{-4}))(2720 - 1010)^3$ ------------------------ 43=_____
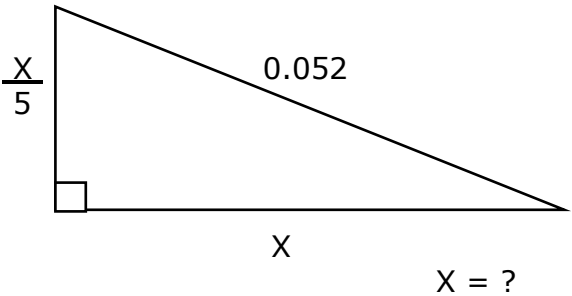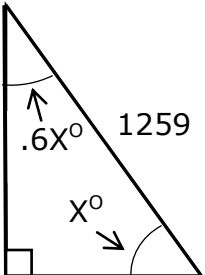
44. $\sqrt{291} + \sqrt{238 + 335} - (\pi)\sqrt{276}$ ------------------------ 44=_____

45. $\dfrac{1}{\sqrt{1900 + 2500 + 2180}} + \left(\dfrac{1}{\sqrt{31}}\right)^2$ ------------------------ 45=_____

46. $\dfrac{(928 + 2740)^{1/2}}{(63.3 - 24.1)^{1/2}}$ -- 46=_____

47. Calculate the area of a circle that has a center point (3, 5) and a
    point on the circle at (8, -2). -------------------------------------- 47=_____

48. Calculate the length of the longest diagonal in a regular nonagon
    with a side length of 7.28 inches. -------------------------------- 48=_____in.

RIGHT TRIANGLE	RIGHT TRIANGLE
$\dfrac{X}{5}$ 0.052 (hypotenuse) X (base) X = ?	.6X° 1259 X° Perimeter = ?
49=_____	50=_____

51. $\left[\dfrac{5.32 - 1.32 + \sqrt{5590/646}}{-18.3 + 28.8}\right]^5$ ---------------------------- 51=_____

52. $\left[\dfrac{\sqrt{\sqrt{12000 - 2740}}}{-(0.0245 - 0.026)}\right]^2 [0.0995 + 0.168]$ ------------------ 52=_____

53. $\dfrac{\sqrt{17.4 + \pi + 3.36}}{(16.1 - 3.15 + 4.32)^3}$ --- 53=_____

54. $\sqrt{\dfrac{1/(73 - 72)}{(4.31)(316 + 250)^4}}$ ------------------------------------- 54=_____

55. $(828)^2 \sqrt{(16.7)/(497)} - (84900 + 41300)$ ---------------- 55=_____
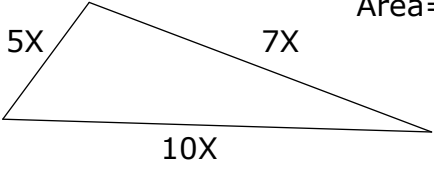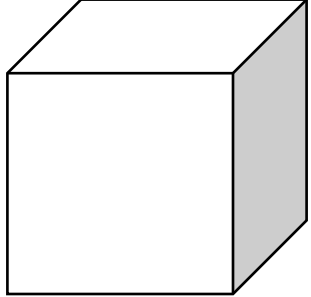
56. $0.715 + \sqrt{(3840)/(816)} - (0.628 + 0.934)^2$ -------------- 56=_____

57. (deg) $\cos(422°) + (1.72/1.42)$ ---------------------------- 57=_____

58. $\sqrt{\dfrac{1/(24.1 - 7.22)}{(756)(105 + 65)^6}}$ ------------------------------------- 58=_____

59. Calculate the distance between the x-intercept and the y-intercept of the line 4x + 3y = 8. --- 59=_____

60. An unknown volume of water at 18.2ºC is added to 27.8 mL of water at 33.6ºC. If the final temperature is 23.5ºC, calculate the unknown volume in mL. Assume the surrounding temperature is of no effect. -- 60=_____mL

SCALENE TRIANGLE

5X   7X

10X

Area= 2791

Shortest Side = ?

61=_____

CUBE

Surface Area = 2.13×10^5

Inner Diagonal = ?

62=_____

63. $\dfrac{30!}{31!} + 2!$ ---   63=_____

64. $(29.3 - \pi)e^{0.174}$ -------------------------------------   64=_____

65. $(9.28 \times 10^7 - 1.06 \times 10^8)^{-5}(4.09 \times 10^8)$ ------------------   65=_____

66.   (rad) $\dfrac{\cos(176)}{23.3/2480}$ ---------------------------------------   66=_____

67.   (rad) $\cos\left[\dfrac{(597)(\pi)}{(1.1)(2.52)}\right]$ ------------------------------   67=_____

68.   (deg) $\dfrac{\sin(232°)}{145 + 74.5}$ ------------------------------------   68=_____

69.   (deg) $\dfrac{\sin(50.9°)}{\tan(50.9°)}[40.2]$ ------------------------------   69=_____

70. $(16.4 - 7.3)e^{\pi - 0.966}$ -----------------------------------   70=_____

71. The probability of Doug having a successful trip is thirteen-fifteenths.
Calculate the odds of not having a successful trip. ---------------   71=_____

72. Sarah and Jim invest the same amount of money, $10,000 in separate
savings accounts for 5 years. Sarah earns 3.15% compounded
annually and Jim earns 2.75% interest compounded quarterly.
After 5 years, find the total amount in the account of the better
investment. ---   72=$_____
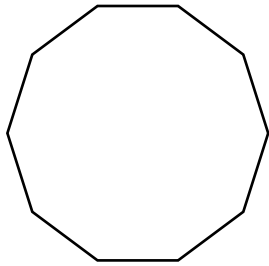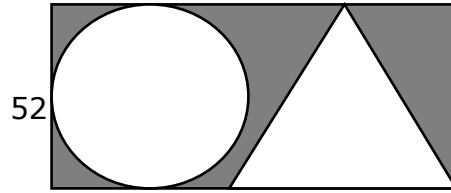
DECAGON	RECTANGLE, CIRCLE, AND EQUILATERAL TRIANGLE
Area = 423.205 Apothem = 11.4127 Length of a side = ?	52 113.75 Shaded Area = ?
73=_____	74=_____

75. $\dfrac{(7.21)^{0.433}(20.1)^{0.848}}{(9.4 - 7.96)^{-6}}$ ------------------------------------- 75=_____

76. $\dfrac{\text{Log}(5.12 + 12.8)}{30200 - 8730}$ --- 76=_____

77. $\dfrac{12400 - 4820}{\text{Log}(28300 + 13300)}$ --- 77=_____

78. $\text{Ln}\left[\dfrac{87.1 + 655 + 567}{183 - 16.6 - \pi}\right]$ ------------------------------------- 78=_____

79. $1 + 3 + 5 + \ldots + 525$ ------------------------------------- 79=_____

80. $1 + \dfrac{(0.72)^4}{2} - \dfrac{(0.72)^6}{6} + \dfrac{(0.72)^8}{24} - \dfrac{(0.72)^{10}}{120}$ ------------- 80=_____

2017-2018 TMSCA Middle School Calculator State Meet Answer Key

Page 1	**Page 2**	**Page 3**	**Page 4**

Page 1

1 = 3980
 = 3.98×10^3

2 = 63.0
 = 6.30×10^1

3 = 3880
 = 3.88×10^3

4 = -4.86
 = -4.86×10^0

5 = -2840
 = -2.84×10^3

6 = -154
 = -1.54×10^2

7 = -0.623
 = -6.23×10^{-1}

8 = -2.20
 = -2.20×10^0

9 = 304000
 = 3.04×10^5

10 = 7.04×10^{10}

11 = 38.2
 = 3.82×10^1

12 = 0.450
 = 4.50×10^{-1}

13 = 24309 INT.

Page 2

14 = 8.21
 = 8.21×10^0

15 = 6.00×10^7

16 = 1.05
 = 1.05×10^0

17 = 2.71
 = 2.71×10^0

18 = 70.2
 = 7.02×10^1

19 = 2.67
 = 2.67×10^0

20 = 7.22
 = 7.22×10^0

21 = 0.00583
 = 5.83×10^{-3}

22 = 0.0588
 = 5.88×10^{-2}

23 = -71.7
 = -7.17×10^1

24 = -1.87
 = -1.87×10^0

25 = 109
 = 1.09×10^2

26 = 55.0
 = 5.50×10^1

Page 3

27 = 58.4
 = 5.84×10^1

28 = 0.0429
 = 4.29×10^{-2}

29 = 8.09×10^{-12}

30 = -148
 = -1.48×10^2

31 = 3.14×10^7

32 = 2.51×10^{-6}

33 = 0.0236
 = 2.36×10^{-2}

34 = 2.64×10^6

35 = 90077 INT.

36 = -2.06×10^{2391}

37 = 1280
 = 1.28×10^3

38 = 237
 = 2.37×10^2

Page 4

39 = 4.95×10^6

40 = 6.70
 = 6.70×10^0

41 = 2.99×10^8

42 = 0.697
 = 6.97×10^{-1}

43 = 7.22×10^{12}

44 = -11.2
 = -1.12×10^1

45 = 0.0446
 = 4.46×10^{-2}

46 = 9.67
 = 9.67×10^0

47 = 232
 = 2.32×10^2

48 = 21.0
 = 2.10×10^1

49 = 0.0510
 = 5.10×10^{-2}

50 = 3010
 = 3.01×10^3

2017-2018 TMSCA Middle School Calculator State Meet Answer Key

Page 5	**Page 6**	**Page 7**

Page 5

51 = 0.126
  = 1.26×10^{-1}

52 = 1.14×10^{7}

53 = 0.000949
  = 9.49×10^{-4}

54 = 1.50×10^{-6}

55 = -527
  = -5.27×10^{2}

56 = 0.444
  = 4.44×10^{-1}

57 = 1.68
  = 1.68×10^{0}

58 = 1.80×10^{-9}

59 = 3.33
  = 3.33×10^{0}

60 = 53.0
  = 5.30×10^{1}

Page 6

61 = 65.5
  = 6.55×10^{1}

62 = 326
  = 3.26×10^{2}

63 = 2.03
  = 2.03×10^{0}

64 = 31.1
  = 3.11×10^{1}

65 = -1.02×10^{-27}

66 = 106
  = 1.06×10^{2}

67 = -0.403
  = -4.03×10^{-1}

68 = -0.00359
  = -3.59×10^{-3}

69 = 25.4
  = 2.54×10^{1}

70 = 80.1
  = 8.01×10^{1}

71 = 0.154
  = 1.54×10^{-1}

72 = $11677.40

Page 7

73 = 7.42
  = 7.42×10^{0}

74 = 2230
  = 2.23×10^{3}

75 = 267
  = 2.67×10^{2}

76 = 5.84×10^{-5}

77 = 1640
  = 1.64×10^{3}

78 = 2.08
  = 2.08×10^{0}

79 = 69200
  = 6.92×10^{4}

80 = 1.11
  = 1.11×10^{0}

11. $37\pi = \pi r^2$ so $r = \sqrt{37}$

$C = 2\pi(\sqrt{37})$

12. $\dfrac{1}{\sqrt[3]{\ln 57912}}$

13. diagonals $= \dfrac{n(n-3)}{2} = \dfrac{222(219)}{2}$

Be sure to look at all digits for the INT.

24. For $ax + by = c$, the slope is $\dfrac{-a}{b}$. Perpendicular slope is $\dfrac{b}{a} =$

$\left(\dfrac{-4}{5}\right) \div \left(\dfrac{3}{7}\right)$

25. $\dfrac{7}{8}(.31)(400)$

26. Arith mean $= \dfrac{2+3+5+7}{4} = 4.25$

Geom mean $= \sqrt[4]{(2)(3)(5)(7)}$

Harm mean $= \dfrac{1}{\left(\frac{\frac{1}{2}+\frac{1}{3}+\frac{1}{5}+\frac{1}{7}}{4}\right)}$

Find Product of these three means.

35.

$5(7^5) + 2(7^4) + 3(7^3) + 4(7^2)$
$+ 2(7^1) + 1$

36. Calculate $(-2121)^{718}$ ignoring the negative since it has an even power. 718 ⎢ENTER⎥

2121 ⎢LOG⎥ ⎢x⎥

⎢SHOW⎥ *(Look at the digits to the left of the decimal. This gives 2388 for the exponent. Write down 2388.)*

2388 ⎢−⎥ ⎢10^x⎥

(This gives 2.86 E0 Multiply 2.86 times negative 721. -2.06 E 3. So add 3 to 2388. Done on the HP RPN calc.

37. $\dfrac{29}{360}[2\pi(512)] + 2(512)$

38. Area $= \dfrac{side^2\sqrt{3}}{4}$ side $=$

$\sqrt{\dfrac{2713(4)}{\sqrt{3}}}$; Perim$=3\left(\sqrt{\dfrac{2713(4)}{\sqrt{3}}}\right)$

47. $r = \sqrt{(5+2)^2 + (3-8)^2}$

$A = \pi r^2$

$= \pi\left[\sqrt{(5+2)^2 + (3-8)^2}\right]^2$

48. Longest diagonal for a regular polygon with an odd number of sides is $\dfrac{side}{2\sin\left(\frac{90}{n}\right)}$

$\dfrac{7.28}{2\sin\left(\dfrac{90}{9}\right)}$

49. $\left(\dfrac{x}{5}\right)^2 + x^2 = .052^2$

$\dfrac{x^2}{25} + \dfrac{25x^2}{25} = \dfrac{26x^2}{25} = .052^2$

$x = \sqrt{\dfrac{.052^2(25)}{26}}$

50. $1.6x + 90 = 180$

$x = \dfrac{90}{1.6}$

Long leg: $y = 1259(\sin 56.25)$
Short leg: $z = 1259(\cos 56.25)$
Perimeter $= 1259 + y + z$

59. x-intercept, let y = 0;
$4x = 8, x = 2$ or $(2,0)$
y-intercept, let x = 0; $3y = 8$,
$y = \dfrac{8}{3}$ or $\left(0, \dfrac{8}{3}\right)$

D $= \sqrt{(2-0)^2 + \left(0 - \dfrac{8}{3}\right)^2}$

60.

$18.2x + 33.6(27.8)$
$= 23.5(27.8 + x)$

$281 = 5.3x; x = \dfrac{281}{5.3}$

61. $s =$ semi-perimeter; a,b,c = the sides of triangle

$\sqrt{s(s-a)(s-b)(s-c)}$
$s = 11x;$

$11x - 10x = x$
$11x - 7x = 4x$
$11x - 5x = 6x$

$\sqrt{11x(x)(4x)(6x)} = 2791$
$11x(x)(4x)(6x) = 2791^2$
$264x^4 = 2791^2$

$x = \sqrt[4]{\dfrac{2791^2}{264}}$ The shortest side is

$5\left(\sqrt[4]{\dfrac{2791^2}{264}}\right)$

62. Surface Area $=$
$2d^2 = 2.13 \times 10^5$

$d = \sqrt{\dfrac{2.13 \times 10^5}{2}}$

71. $\dfrac{2}{13}$

72. Sarah : $10000(1.0315)^5$

Jim: $10000\left(1 + \dfrac{.0275}{4}\right)^{(4)(5)}$

Sarah's is the better investment.

73. $A = \dfrac{1}{2}aP$

$423.205 = \dfrac{1}{2}(11.4127)P$

$P = \dfrac{423.205\,(2)}{11.4127}$

Side $= \dfrac{423.205\,(2)}{11.4127} \div 10$

74. Area of rectangle minus area of circle minus area of triangle.

$triangle = \dfrac{h^2\sqrt{3}}{3}$

$(113.75)(52) - \pi 26^2 - \dfrac{52^2\sqrt{3}}{3}$

11. $37\pi = \pi r^2$ so $r = \sqrt{37}$
$C = 2\pi(\sqrt{37})$

12. $\dfrac{1}{\sqrt[3]{\ln 57912}}$

13. diagonals $= \dfrac{n(n-3)}{2} = \dfrac{222(219)}{2}$
Be sure to look at all digits for the INT.

24. For $ax + by = c$, the slope is $\dfrac{-a}{b}$. Perpendicular slope is $\dfrac{b}{a} =$
$\left(\dfrac{-4}{5}\right) \div \left(\dfrac{3}{7}\right)$

25. $\dfrac{7}{8}(.31)(400)$

26. Arith mean $= \dfrac{2+3+5+7}{4} = 4.25$
Geom mean $= \sqrt[4]{(2)(3)(5)(7)}$
Harm mean $= \dfrac{1}{\left(\dfrac{\frac{1}{2}+\frac{1}{3}+\frac{1}{5}+\frac{1}{7}}{4}\right)}$
Find Product of these three means.

35.
$5(7^5) + 2(7^4) + 3(7^3) + 4(7^2)$
$\qquad + 2(7^1) + 1$

36. Calculate $(-2121)^{718}$ ignoring the negative since it has an even power. 718 | ENTER |
2121 | LOG | | x |

| SHOW | *(Look at the digits to the left of the decimal. This gives 2388 for the exponent. Write down 2388.)*

2388 | – | | 10^x |
(This gives 2.86 E0 Multiply 2.86 times negative 721.   -2.06 E 3. So add 3 to 2388. Done on the HP RPN calc.

37. $\dfrac{29}{360}[2\pi(512)] + 2(512)$

38. Area $= \dfrac{side^2\sqrt{3}}{4}$ side $=$
$\sqrt{\dfrac{2713(4)}{\sqrt{3}}}$;   Perim$=3\left(\sqrt{\dfrac{2713(4)}{\sqrt{3}}}\right)$

47. $r = \sqrt{(5+2)^2 + (3-8)^2}$
$A = \pi r^2$
$\quad = \pi\left[\sqrt{(5+2)^2 + (3-8)^2}\right]^2$

48. Longest diagonal for a regular polygon with an odd number of sides is $\dfrac{side}{2\sin\left(\frac{90}{n}\right)}$
$$\dfrac{7.28}{2\sin\left(\dfrac{90}{9}\right)}$$

49. $\left(\dfrac{x}{5}\right)^2 + x^2 = .052^2$
$\dfrac{x^2}{25} + \dfrac{25x^2}{25} = \dfrac{26x^2}{25} = .052^2$
$x = \sqrt{\dfrac{.052^2(25)}{26}}$

50. $1.6x + 90 = 180$
$x = \dfrac{90}{1.6}$
Long leg: $y = 1259(\sin 56.25)$
Short leg: $z = 1259(\cos 56.25)$
Perimeter $= 1259 + y + z$

59. x-intercept, let y = 0;
$\quad 4x = 8, x = 2$ or $(2,0)$
y-intercept, let x = 0; $3y = 8$,
$\quad y = \dfrac{8}{3}$ or $\left(0, \dfrac{8}{3}\right)$
D $= \sqrt{(2-0)^2 + \left(0 - \dfrac{8}{3}\right)^2}$

60.
$18.2x + 33.6(27.8)$
$\qquad = 23.5(27.8 + x)$
$281 = 5.3x; x = \dfrac{281}{5.3}$

61. $s =$ semi-perimeter; a,b,c = the sides of triangle
$$\sqrt{s(s-a)(s-b)(s-c)}$$
$s = 11x;$
$11x - 10x = x$
$11x - 7x = 4x$
$11x - 5x = 6x$
$\sqrt{11x(x)(4x)(6x)} = 2791$
$11x(x)(4x)(6x) = 2791^2$
$264x^4 = 2791^2$
$x = \sqrt[4]{\dfrac{2791^2}{264}}$ The shortest side is
$5\left(\sqrt[4]{\dfrac{2791^2}{264}}\right)$

62. Surface Area $=$
$\quad 2d^2 = 2.13 \times 10^5$
$d = \sqrt{\dfrac{2.13 \times 10^5}{2}}$

71. $\dfrac{2}{13}$

72. Sarah : $10000(1.0315)^5$
Jim: $10000\left(1 + \dfrac{.0275}{4}\right)^{(4)(5)}$
Sarah's is the better investment.

73. $A = \dfrac{1}{2}aP$
$423.205 = \dfrac{1}{2}(11.4127)P$
$P = \dfrac{423.205\,(2)}{11.4127}$
$\quad$ Side $= \dfrac{423.205\,(2)}{11.4127} \div 10$

74. Area of rectangle minus area of circle minus area of triangle.
$triangle = \dfrac{h^2\sqrt{3}}{3}$
$(113.75)(52) - \pi 26^2 - \dfrac{52^2\sqrt{3}}{3}$