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**

**T E S T  # 1 2 ©**

**F E B R U A R Y  1 8 ,  2 0 2 3**

**GENERAL DIRECTIONS**

I.  About this test:
   A.  You will be given 30 minutes to take this test.  There are 80 problems on this test.
II.  **Calculators limited to the types specified by UIL.  Calculators are no longer required to be cleared.**
III.  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.*, $1.23\text{x}10$*, $1.23\text{x}10^0$*, $1.23\text{x}10^1$, $1.23\text{x}10^{01}$, .0190, $1.90\text{x}10^{-2}$
         Incorrect:  12.30, 123.0, $1.23(10)^2$, $1.23^.10^2$, $1.230\text{x}10^2$, $1.23*10^2$, 0.19, $1.9\text{x}10^{-2}$, $19.0\text{x}10^{-3}$, 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.
   IV. 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).
   V.  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.

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# 2022 – 2023 TMSCA Middle School Calculator Test 12

1.      776 − 851  ---------------------------------------------------  1=_____

2.      −12 − 8 − 29 -----------------------------------------------  2=_____

3.      913 + 691 + 1170  -------------------------------------------  3=_____

4.      $\pi$ + 4 + 2 + 8 -------------------------------------------------  4=_____

5.      124 − 243 − 477 − 190  -------------------------------------  5=_____

6.      87.9 + 176 − 225 − 296 − 107  ------------------------------  6=_____

7.      −0.619 − 0.509 + 0.896 − 0.5 − 1.13 --------------------  7=_____

8.      (−4.11 − 4.82) + (6.72 − 3.58 − 7.53) --------------------  8=_____

9.      601 x 363 x 99.7 --------------------------------------------  9=_____

10.     796 x 768 x 275 x 103 --------------------------------------  10=_____

11. Cindy completed her TMSCA calculator test.  She got a score of 319.
    Calculate the number of problems she got incorrect.  -------------  11=_____INT.

12. The area of an isosceles right triangle is 528 square inches. Calculate
    the length of a side in inches.  ---------------------------------------  12=_____in.

13. Big Tex at the Texas State Fair is said to wear a 95 gallon hat.
    Calculate the number of cubic inches in his hat.  ------------------  13=_____in.³

14.        $(-107)[116 \times 135/95]$  ----------------------------------- 14=_____

15.        $(235/54)[190 - 119]$  -------------------------------------- 15=_____

16.        $\{292/541\}\left[\dfrac{319}{226 + 88}\right]$  ------------------------------------- 16=_____

17.        $\left[\dfrac{405}{117}\right][(562/188) + 1.41]$  ----------------------------------- 17=_____

18.        $\dfrac{(184/99) + (87/175)}{(7.47 \times 10^{-4} - 9.82 \times 10^{-4})}$  ---------------------------------- 18=_____

19.        $\dfrac{[0.635/(1.12)]/24.8}{(0.126 \times 0.0288)(218)}$  ----------------------------------- 19=_____

20.        $(0.649)[427/552 \times 543/363] - 0.453$  --------------------- 20=_____

21.        $\dfrac{(2.55 \times 10^{-4})(3.99 \times 10^{-4})}{3140}(2.5 - 12.9)$  -------------------- 21=_____

22.        $\left[\dfrac{1320 + 1480}{1450 - 1420}\right]\left[\dfrac{389}{420}\right]$  --------------------------------------- 22=_____

23.        $\dfrac{(2130 + 3220 - 4060)}{\{(\pi - 2.41)/(852)\}}$  ------------------------------------- 23=_____

24. Calculate the geometric mean of the first five largest prime numbers
    less than 100.   ------------------------------------------------- 24=_____

25. Fredrico received a 25% discount on his purchase.  He purchased
    $587.22 worth of items before his discount.  Calculate how much
    was taken off at the register.  -------------------------------------- 25=$_____

26. Calculate one-tenth of 22% of one billion, eleven.  ----------------- 26=_____

27. $\dfrac{(14.3 - 9.54)(36.9 + 158)}{(5.81 \times 10^{11})}$ ------------------------------------- 27=_____

28. $\dfrac{(7.66 \times 10^{12}) + (8.91 \times 10^{12})}{(-0.483)(0.587) - 0.0502}$ ------------------------------- 28=_____

29. $(199)\big[(0.0069/0.00493)(0.774/5.53)\big]$ ------------------ 29=_____

30. $\dfrac{1}{-33.1} + \dfrac{1}{(\pi)(69.4 - 92.1)}$ ----------------------------------- 30=_____

31. $(47.4)\big[(8.44 \times 10^{7}) - (4.14 \times 10^{8})\big]$ ----------------------- 31=_____
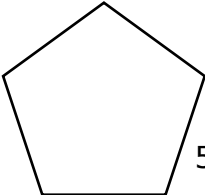
32. $[485]\left[\dfrac{1/440}{1/295}\right]$ ------------------------------------------- 32=_____

33. $\dfrac{1}{68.7} - \dfrac{1}{(70.7 + 104)}$ ----------------------------------------- 33=_____

34. $\left[\dfrac{1/657}{1/808}\right][6.63 \times 10^{5}]$ ---------------------------------------- 34=_____

35. The volume of a cube and a sphere are equal.  If the edge of the
cube measures 212 cm, calculate the radius of the sphere in cm.    35=_____cm

36. Thirty-two and five-eighths is what percent more than ten and
two-thirds.   -------------------------------------------------------------- 36=_____

| 37. | 38. |
|---|---|
| RECTANGLE | REGULAR PENTAGON |
| Area = 627890 | |
| 518 | 5.71 |
| Perimeter = ? | Apothem = ? |
| 37= _____ | 38= _____ |

39.        $(6.48 + 4.33)^2(4.69 + 20.1)^2$  ---------------------------- 39=_____

40.        $\dfrac{(7580 + 4690)^2}{(0.0152 - 0.0176)^3}$  ---------------------------------------- 40=_____

41.        $\left[\dfrac{42.6}{160}\right](769 + 363)^4$  ---------------------------------------- 41=_____

42.        $(6540)\sqrt{4660 + 8220 + 3920}$  --------------------------- 42=_____

43.        $\sqrt{133} + \sqrt{26.5 + 130} - (\pi)\sqrt{115}$  --------------------------- 43=_____
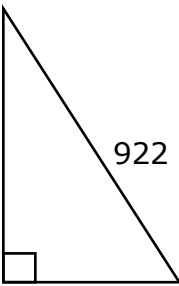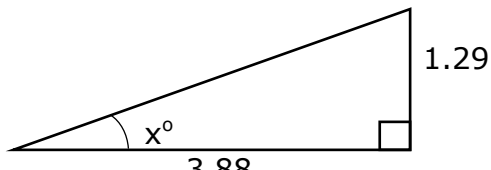
44.        $(1/(0.0327))(2990 - 2000)^3$  ---------------------------- 44=_____

45.        $\dfrac{(12.4 + 3.96)^{1/4}}{(11 - 4.53)^{1/4}}$  ---------------------------------------- 45=_____

46.        $\left[\sqrt[4]{(942/1080)(410)}\right]^2$  ------------------------------------- 46=_____

47. Tina drove home for Christmas break.  For the first 180 miles she
    averaged 66 mph.  She stopped a half hour for lunch and to stretch
    her legs.  For the last 210 miles she averaged 72 mph.  Calculate
    her average speed for the complete trip.  ------------------------- 47=_____mph

48. Calculate the sum of the roots of the quadratic equation
                    $12x - 7x^2 = 5$                          ---------- 48=_____

49.
        RIGHT TRIANGLE



        922

        455              Area = ?

49= _____

50.
        RIGHT TRIANGLE



                        1.29

        x°
              3.88

                   x° = ?

50= _____

51. $$\left[\frac{16.4 - 11.1 + \sqrt{534/45.9}}{-224 + 314}\right]^{-5}$$ ---------------------------- 51=_____

52. $$\frac{\sqrt{4.71 + \pi + 0.919}}{(5370 - 6750 + 8950)^2}$$ ----------------------------------- 52=_____

53. $$\frac{(93700 + 1.14\text{x}10^5 - 1.37\text{x}10^5)^3}{\sqrt{0.028 + 0.0247 + 0.0105}}$$ ------------------------ 53=_____

54. $$\sqrt{\frac{(43400)(2.47\text{x}10^5)}{(1.27\text{x}10^5)(2.62\text{x}10^5)}} - 0.431 + 0.425$$ -------------- 54=_____

55. $$\sqrt{\frac{1/(240 - 210)}{(57)(41.9 + 122)^2}}$$ ---------------------------------------- 55=_____

56. $0.518 + \sqrt{(237)/(139)} - (0.257 + 0.538)^2$ --------------- 56=_____

57. $(\text{rad}) \sin(5.28) + (3.74/2.08)$ ---------------------------- 57=_____

58. $$\sqrt{\frac{(791)(2860)}{(19.2) + (31.6)}} - 724$$ ----------------------------------- 58=_____

59. Rod wants a 100-gallon tank filled with 52° F water.  He has 100° F
    water and 35° F water.  Calculate the number of gallons of the
    100° F water he will have to use.  ----------------------------------- 59=_____gal.

60. Numbered tiles 1-100 inclusive are put into a bag.  One tile is drawn
    at random.  Calculate the probability of drawing a prime number.   60=_____

61.
CONE

13.445

3.89

Volume = ?

61=_____

62.
ISOSCELES TRIANGLE

621

130°

Area = ?
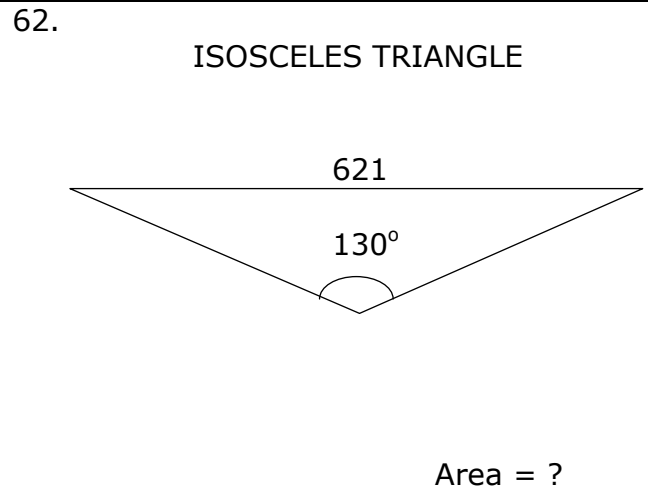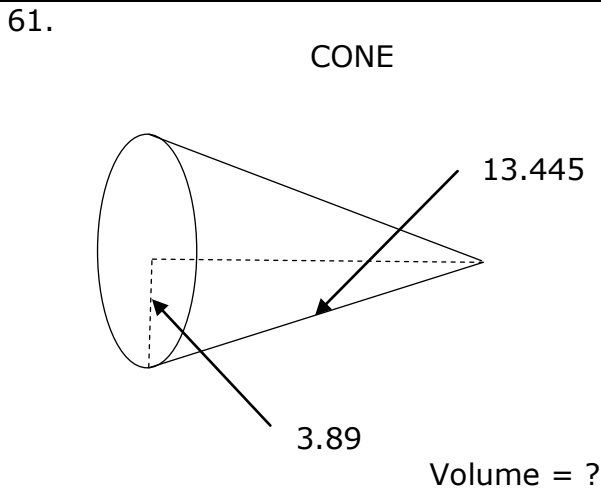
62=_____

63.     $\dfrac{9! + 11!}{16!}$  ------------------------------------------------------- 63=_____

64.     (deg) (37.9 + 51)tan(10.7°)  ---------------------------- 64=_____

65.     $(8.22 \times 10^8 - 8.35 \times 10^8)^{-9}(3.16 \times 10^8)$  -------------------- 65=_____

66.     (deg) [16]tan(56.8° − 33.2°)  ---------------------------- 66=_____

67.     (deg) sin(63.7° − 39.9°) + 0.224  ------------------------ 67=_____

68.     (deg) $\dfrac{\sin(208°)}{\tan(208°)}[526]$  ------------------------------------- 68=_____

69.     (rad) tan[(33.2 − 23.7)(5.91)]  ---------------------------- 69=_____

70.     $(211 + 148 + 104)^{3/5}$  ----------------------------------- 70=_____
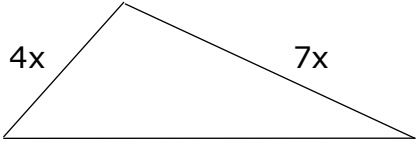
71. Mrs. Clark has 29 math projects to display and wants to arrange
    5 of them in the library at a time.  Calculate the number of ways
    to do this if the order of the projects is not important.  ----------- 71=_____INT.

72. Calculate the product of the fifth hexagonal number and the fifth
    pentagonal number.  ------------------------------------------------- 72=_____INT.
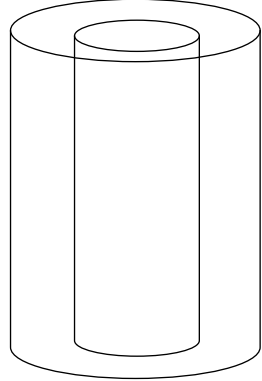
| 73. | 74. |
|---|---|
| SCALENE TRIANGLE | HOLLOW CYLINDER |

73.

SCALENE TRIANGLE

Area = 133

4x          7x

9x

Perimeter = ?

73= _____

74.

HOLLOW CYLINDER

Inner radius = 2.28

Outer radius = 5.59

Height = 8.22

Volume= ?

74= _____

75. $\text{Ln}\left[\dfrac{47.7 + 134 + 93.7}{98.5 + 129 - 99.9}\right]$ ------------------------------------- 75=_____

76. $\dfrac{(11.1)^{0.173}(15)^{0.687}}{(24.6 - 24.1)^{-7}}$ ------------------------------------- 76=_____

77. $(26000)10^{(0.479)(4.13)}$ --------------------------------- 77=_____

78. $(20.9)^{\pi}(104)^{2}(421 - 375)^{4}$ ------------------------------- 78=_____

79. $4 + 6 + 8 + \ldots + 728$ ------------------------------------- 79=_____

80. $1 + \dfrac{(0.629)^{4}}{2} - \dfrac{(0.629)^{6}}{6} + \dfrac{(0.629)^{8}}{24} - \dfrac{(0.629)^{10}}{120}$ --------- 80=_____

# 2022 – 2023 TMSCA Middle School Calculator Test 12 Answer Key

| Page 1 | Page 2 | Page 3 | Page 4 |
|---|---|---|---|

**Page 1**

1 = -75.0
  = $-7.50 \times 10^1$

2 = -49.0
  = $-4.90 \times 10^1$

3 = 2770
  = $2.77 \times 10^3$

4 = 17.1
  = $1.71 \times 10^1$

5 = -786
  = $-7.86 \times 10^2$

6 = -364
  = $-3.64 \times 10^2$

7 = -1.86
  = $-1.86 \times 10^0$

8 = -13.3
  = $-1.33 \times 10^1$

9 = $2.18 \times 10^7$

10 = $1.73 \times 10^{10}$

11 = 9 INT.

12 = 32.5
  = $3.25 \times 10^1$

13 = 21900
  = $2.19 \times 10^4$

**Page 2**

14 = -17600
  = $-1.76 \times 10^4$

15 = 309
  = $3.09 \times 10^2$

16 = 0.548
  = $5.48 \times 10^{-1}$

17 = 15.2
  = $1.52 \times 10^1$

18 = -10000
  = $-1.00 \times 10^4$

19 = 0.0289
  = $2.89 \times 10^{-2}$

20 = 0.298
  = $2.98 \times 10^{-1}$

21 = $-3.37 \times 10^{-10}$

22 = 86.4
  = $8.64 \times 10^1$

23 = $1.50 \times 10^6$

24 = 83.8
  = $8.38 \times 10^1$

25 = $146.81

26 = $2.20 \times 10^7$

**Page 3**

27 = $1.60 \times 10^{-9}$

28 = $-4.97 \times 10^{13}$

29 = 39.0
  = $3.90 \times 10^1$

30 = -0.0442
  = $-4.42 \times 10^{-2}$

31 = $-1.56 \times 10^{10}$

32 = 325
  = $3.25 \times 10^2$

33 = 0.00883
  = $8.83 \times 10^{-3}$

34 = 815000
  = $8.15 \times 10^5$

35 = 132
  = $1.32 \times 10^2$

36 = 206
  = $2.06 \times 10^2$

37 = 3460
  = $3.46 \times 10^3$

38 = 3.93
  = $3.93 \times 10^0$

**Page 4**

39 = 71800
  = $7.18 \times 10^4$

40 = $-1.09 \times 10^{16}$

41 = $4.37 \times 10^{11}$

42 = 848000
  = $8.48 \times 10^5$

43 = -9.65
  = $-9.65 \times 10^0$

44 = $2.97 \times 10^{10}$

45 = 1.26
  = $1.26 \times 10^0$

46 = 18.9
  = $1.89 \times 10^1$

47 = 63.5
  = $6.35 \times 10^1$

48 = 1.71
  = $1.71 \times 10^0$

49 = 182000
  = $1.82 \times 10^5$

50 = 18.4
  = $1.84 \times 10^1$

# 2022 – 2023 TMSCA Middle School Calculator Test 12 Answer Key

| Page 5 | Page 6 | Page 7 |
|---|---|---|

**Page 5**

51 = 118000
$\quad$ = $1.18 \times 10^{5}$

52 = $5.17 \times 10^{-8}$

53 = $1.41 \times 10^{15}$

54 = 0.562
$\quad$ = $5.62 \times 10^{-1}$

55 = 0.000148
$\quad$ = $1.48 \times 10^{-4}$

56 = 1.19
$\quad$ = $1.19 \times 10^{0}$

57 = 0.955
$\quad$ = $9.55 \times 10^{-1}$

58 = -513
$\quad$ = $-5.13 \times 10^{2}$

59 = 26.2
$\quad$ = $2.62 \times 10^{1}$

60 = 0.250
$\quad$ = $2.50 \times 10^{-1}$

**Page 6**

61 = 204
$\quad$ = $2.04 \times 10^{2}$

62 = 45000
$\quad$ = $4.50 \times 10^{4}$

63 = $1.93 \times 10^{-6}$

64 = 16.8
$\quad$ = $1.68 \times 10^{1}$

65 = $-2.98 \times 10^{-56}$

66 = 6.99
$\quad$ = $6.99 \times 10^{0}$

67 = 0.628
$\quad$ = $6.28 \times 10^{-1}$

68 = -464
$\quad$ = $-4.64 \times 10^{2}$

69 = -0.427
$\quad$ = $-4.27 \times 10^{-1}$

70 = 39.8
$\quad$ = $3.98 \times 10^{1}$

71 = 118755 INT.

72 = 1575 INT.

**Page 7**

73 = 63.0
$\quad$ = $6.30 \times 10^{1}$

74 = 673
$\quad$ = $6.73 \times 10^{2}$

75 = 0.769
$\quad$ = $7.69 \times 10^{-1}$

76 = 0.0761
$\quad$ = $7.61 \times 10^{-2}$

77 = $2.47 \times 10^{6}$

78 = $6.80 \times 10^{14}$

79 = 133000
$\quad$ = $1.33 \times 10^{5}$

80 = 1.07
$\quad$ = $1.07 \times 10^{0}$

**11.** $400 - 319 = 9x$

$$x = \frac{400 - 319}{9}$$

**12.** $\frac{x^2}{2} = 528;\ x^2 = 528(2)$

$$x = \sqrt{(528)(2)}$$

**13.** 231 cubic inches = 1 gal.

$$95(231)$$

**24.** $\sqrt[5]{97(89)(83)(79)(73)}$

**25.** $587.22(.25)$

**26.** $\frac{1}{10}(.22)(1{,}000{,}000{,}011)$

**35.** $212^3 = \frac{4}{3}\pi r^3$

$$r = \sqrt[3]{\frac{212^3(3)}{4\pi}}$$

**36.** With a % chg key,

Enter $10\frac{2}{3}$ followed by $32\frac{5}{8}$. Then % chg key.

Otherwise, $\frac{32\frac{5}{8} - 10\frac{2}{3}}{10\frac{2}{3}} \cdot 100$

**37.** Length: $\frac{627890}{518}$

Perimeter: 2L + 2W

$$2\left(\frac{627890}{518}\right) + 2(518)$$

**38.** The central angle of a pentagon is 360/5 = 72 degrees. The apothem creates a right triangle with angle 72/2 or 36 degrees and a base of 5.71/2.

**38. contd.**

$$\frac{\tan 36}{1} = \frac{\frac{5.71}{2}}{x}$$

$$x = \frac{5.71}{2} \div \tan 36$$

**47.** $\frac{total\ distance}{total\ time}$

$$time_1 = \frac{180}{66};\ time_2 = \frac{210}{72}$$

$$time_3 for\ lunch = .5$$

$$\frac{180 + 210}{\frac{180}{66} + \frac{210}{72} + .5}$$

**48.** $0 = 7x^2 - 12x + 5$

$$a = 7, b = -12$$

Sum of the roots = $-\frac{b}{a} = \frac{12}{7}$

**49.** Long leg =

$$\sqrt{922^2 - 455^2}$$

Area = $\frac{(\sqrt{922^2 - 455^2})(455)}{2}$

**50.** $\tan x = \frac{1.29}{3.88}$

$$x = atan\left(\frac{1.29}{3.88}\right)$$

**59.** $\begin{cases} x + y = 100 \\ 100x + 35y = 100(52) \end{cases}$

From 1st equation above,

$$y = 100 - x$$

$$100x + 35(100 - x) = 5200$$

$$100x + 3500 - 35x = 5200$$

$$x = \frac{5200 - 3500}{65}$$

**60.** There are 25 prime numbers less than 100. (Memorize this fact.)

$$\frac{25}{100}$$

**61.** $V = \frac{1}{3}\pi r^2 h$

$$h = \sqrt{13.445^2 - 3.89^2}$$

$$\frac{1}{3}\pi(3.89)^2\left(\sqrt{13.445^2 - 3.89^2}\right)$$

**62.** The height of this triangle will make the vertex angle $65^0$ and will divide the 621 in half.

$$\tan 65 = \frac{621/2}{x}$$

$$x = \frac{621/2}{\tan 65}$$

Area = $\frac{621}{2}\left(\frac{621/2}{\tan 65}\right)$

**71.** This is a combination problem since order doesn't matter. Combinations of choosing 5 projects from 29 is

$$\frac{29!}{5!24!}$$

**72.** Interesting way to learn formulas for polygonal numbers:

Pentagonal: $\frac{n(3n-1)}{2}$

Hexagonal: $\frac{n(4n-2)}{2}$

Heptagonal: $\frac{n(5n-3)}{2}$

Octagonal: $\frac{n(6n-4)}{2}$

Notice the factor in the parentheses is the number of sides in the shape − 2 and − 4. This works every time and saves trying to memorize a different formula.

$$\left(\frac{n(4n-2)}{2}\right)\left(\frac{n(3n-1)}{2}\right)$$

$$\left(\frac{5(20-2)}{2}\right)\left(\frac{5(15-1)}{2}\right)$$

$$(45)(35)$$

**73.** Semi perimeter = $10x$

$$A = \sqrt{s(s-a)(s-b)(s-c)}$$
$$s - a = 10x - 7x = 3x$$
$$s - b = 10x - 9x = x$$
$$s - c = 10x - 4x = 6x$$
$$133 = \sqrt{10x(3x)(x)(6x)}$$
$$133 = \sqrt{180x^4}$$
$$133^2 = 180x^4$$
$$x = \sqrt[4]{\frac{133^2}{180}}$$

Perimeter is $20x =$

$$20\left(\sqrt[4]{\frac{133^2}{180}}\right)$$

**74.** Subtract the two volumes
$$\pi(5.59)^2(8.22) - \pi(2.28)^2(8.22)$$
$$8.22\pi(5.59^2 - 2.28^2)$$