Elementary & Junior High

Problem Solving

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Azle ISD – 1974 to 2017

7^{th} grade math, high school math & Physics teacher

ETS Physics reader – 10 years

Married – 4 children & 3 grandchildren

Co-founder Texas Math and Science Coaches Association (TMSCA)

- **Hospitality**: Water will be available outside of each conference room. A light snack will be served between sessions 2 and 3 on Tuesday and prior to first session on Wednesday.

- **Lunch**: There are numerous water stations and eating options throughout the property..

- **Reception:** Please remind attendees on Tuesday, immediately following the last session, to join us for the all-conference reception in the AT&T Courtyard with hors d'oeuvres and cash bar.

- **Handouts**: All attendees will have **Internet access** during the conference and are encouraged to use their laptops and personal devices to access workshop documents online. Remind attendees that handouts and presentations are available online and may be accessed during your session. We have requested that all attendees bring their personal devices.

Attention All Attendees:

Thank you for registering your attendance for **EACH SESSION**:

UIL MS Calculator Applications Contest

The calculator applications contest is designed to stimulate the development of mathematical and calculator skills for students in grades 6,7 and 8. Goals are both intellectual and practical: developing mathematical reasoning and knowledge and requiring the application of problem-solving skills toward realistic problems.

Students will take a test containing 80 problems in 30 minutes

Students may use any silent, hand-held calculator that does not require auxiliary electric power. The calculator data and program memory should be cleared prior to the contest.

Students **may not** use pre-recorded programs during the contest.

Students may also use additional paper (provide by the contest director) besides writing on the contest paper itself.

Only answers should be written in the answer blank and once an answer has been written in the answer blank that answer blank

problem solving process. They should be familiar with all the conversions that are available to them via their calculator.

Some conversions the students should know and may not be on their calculator (memorize if need be) are:

(1) US monetary conversions

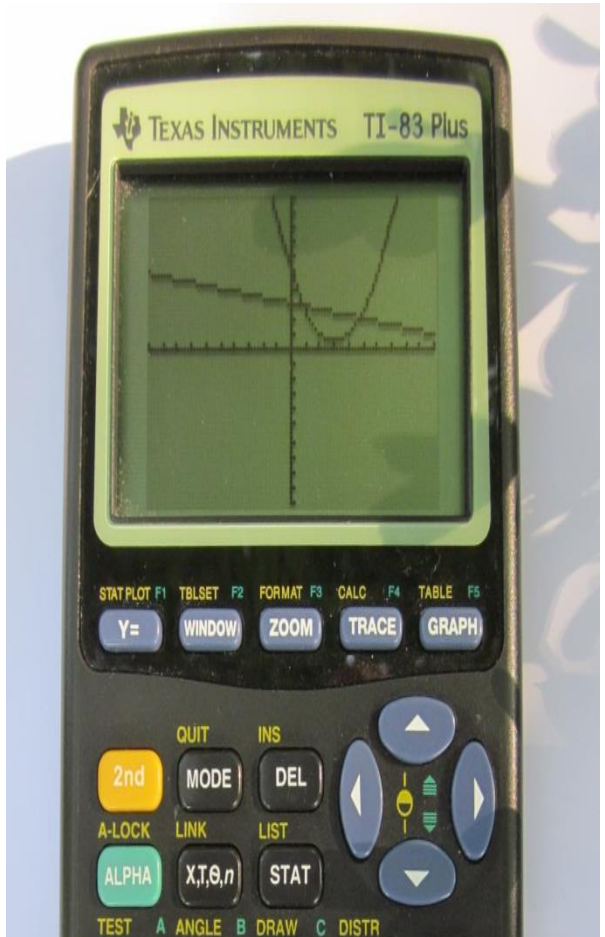
(2) English system linear measurement conversion

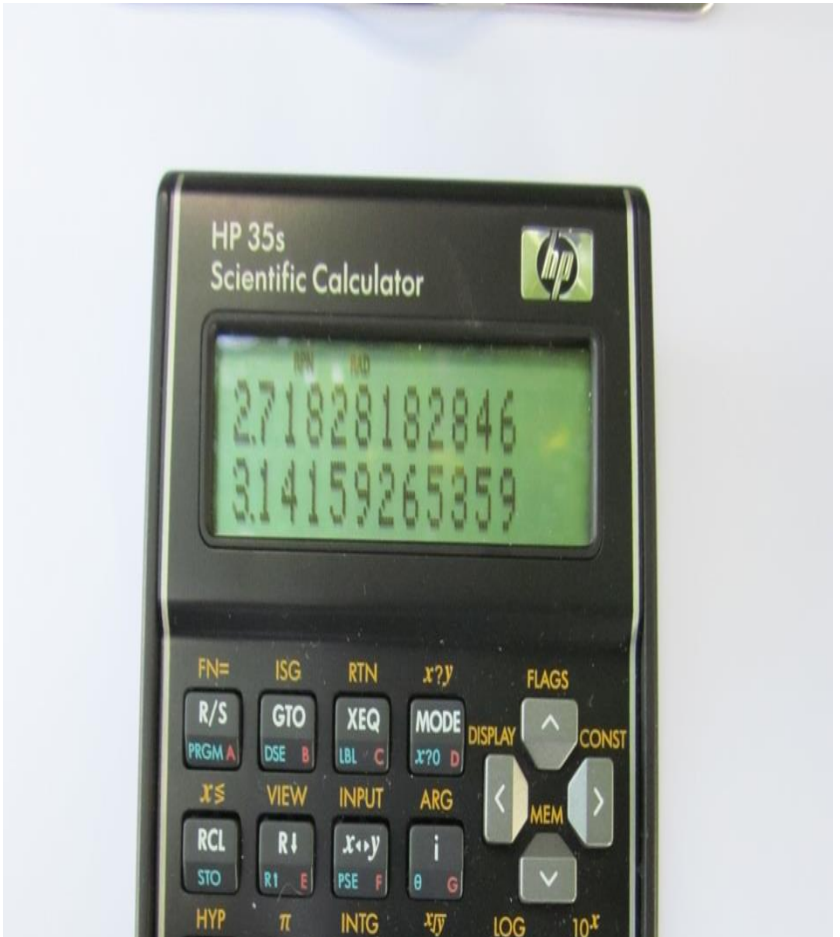
(3) Standard time unit conversions

(4) Standard English area and volume conversions

Any other required conversions will be given in the problem.

Examples of Typical Calculators





The format of the middle school calculator contest is **NOT** the same as the high school calculator contest.

Problems 1 – 10	(number crunchers)	**P.1**
Problems 11 – 13	(stated problems)	**P.1**
Problems 14 – 23	(number crunchers)	**P.2**
Problems 24 – 26	(stated problems)	**P.2**
Problems 27 – 34	(number crunchers)	**P.3**

All number cruncher problems and all geometry problem answers must be written in three significant digit (SD) format.

Example-1

Display reads: 2345.77

Answer should be written as 2350 or 2.35×10^3

Example-2

Display reads: 0.000803111

All problems that require an integer answer will have the word “Integer” in the answer blank and have to be written as an integer number. No scientific notation can be used. All monetary problems requiring a US-dollar “$” answers must be written to the cent.

Example-4

Display reads: 456.7072

Answer is: 456.71

There are fourteen stated problems. Some stated problems just involve a straightforward calculation. Some stated problems that you might see involve motion with average speed where the problems use the distance = rate x time formula. Another type of motion problem involves motion where acceleration is involved. The formulas for these problems are more complicated and in most instances will be given in the problem itself. There may be problems related to probability/odds; some related to the Pythagorean

formula for some process is described and the student is required to interpret the words to come up with the formula in order to solve the problem. Some stated problems that you might see are in an algebra I course and could require the use of the quadratic formula. There may be some stated problems whereby students are required to use a geometric formula.

Example-5

The sum of pi, 12.8 and the positive value of $\sqrt{12}$ is

Example-6

If every Cupro-Nickel dime has a mass of

2.268 grams, at most how many dimes are in

a mass of 2.50 kilograms of dimes? ---------- 13=____dimes(Integer)

$$2.50\cancel{kg} \times \left(\frac{1000\cancel{g}}{1\cancel{kg}} \right) \div \left(\frac{2.268\,\cancel{g}}{1\,\text{dime}} \right) = 1102.2927\ldots$$

Example-7

The speed of a radio wave traveling through space is 3.00×10^5 km/s. How long would it take a radio wave to travel from Jupiter to Earth, an average distance of 6.29×10^8 kilometers?---------- 25=_____s

$(6.29 \times 10^8 \text{ km}) \div (3.00 \times 10^5 \text{ km/s}) = 2096.666\ldots$

Example-8

What is the volume in a pipe that measures

three-quarters of an inch in inner diameter and is

one-quarter mile long?---------- 47=_____ in^3

Volume of a cylinder (pipe) = $\pi r^2 l$; where r = radius and l = length

$$V_{cyl} = \pi(.75\ in/2)^2 \times \left[0.25\ \cancel{mi} \times \left(\frac{5280\ \cancel{ft}}{}\right) \times \left(\frac{12\ in}{}\right)\right]$$

Example-9

One morning a 30-foot flagpole cast a shadow that measured 49 feet, 8.5 inches long. At the same time, how long of a shadow would Dan cast if he is standing 5 foot, 10 inches tall?---------- 25=_____ft

$$\frac{30\ \text{ft}}{49\ \text{ft} + 8.5\ \text{in}/12} = \frac{5\ \text{ft} + 10\ \text{in}/12}{S}$$

Example-10

The distance traveled when something is uniformly changing speeds (accelerating) is found by taking the average of the beginning and final speeds and multiplying that average by the time it took to change speeds. So, how far does a car travel during the 5.0 seconds it took to uniformly speed up from 55 miles per hour (mph) to 65 mph?---------- 59=_____ft

Example-11

Twice a certain number, greater than 1, plus its reciprocal is 10. What is that number?----------72=_____

$2n + 1/n = 10 \quad \rightarrow 2n^2 + 1 = 10n \quad \rightarrow 2n^2 - 10n + 1 = 0$

$$n = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a} \qquad n = \frac{-(-10) \pm \sqrt{(-10)^2 - 4(2)(1)}}{2(2)}$$

Example-12

Mrs. Saenz, the science teacher, normally picks students at random to answer questions about the topic she is teaching that day. If there are 11 girls and 12 boys in her class what is the probability that Mrs. Saenz will pick a girl to answer the first question of class?----------36=_____

Example-13

Dan took a 10 ft long ladder and leaned it up against a wall. Safety instructions that came with the ladder indicated that the bottom of the ladder should be no further than 4 feet from the wall. What is the lowest possible height reached up the wall the top of the ladder could reach following safety standards?---- 47=_____ft

Example-14

One day, it was Sarah's turn to only pay the 15% gratuity (tip) for the meal she and her four girl friends had. If the bill, with tax, came to $48.75, how much did Sarah pay?----------35=$_____

G = ($48.75) x (0.15)

Example-15

When Anna turned 15 years old, her parents provided a quinceañera party that lasted 4 hours and included 75 guests. If the building rental was $125/hour, the band cost $100/hour and guests were fed at the rate of $12.50/guest, how much did the party cost?--------36=$_____

C = ($125/hr)x(4 hr) + ($100/hr)x(4 hr) + ($12.50/guest)x(75 guests)

In the calculator applications contest there are three types of percent comparison problems to be solved.

They are:

(1) Percent Error

(2) Percent Increase

(3) Percent Decrease

These problem types are different than the ones that basically just compare two quantities, i.e. 1.25 grams is what percent of 4

Let’s look at each problem type equation and an associated example.

Percent Error

Equation ➔ $$\%Error = 100\,x\left[\frac{approximate}{exact} - 1\right]$$

Example – 16

Percent Error

Equation ➔ $$\%Error = 100\,x\left[\frac{approximate}{exact} - 1\right]$$

Example – 17

What is the percent error in using 365 days/year given

that a year is defined as 365.256 days?----------13=_____%

Percent Increase

Equation ➔ $$\%\text{Increase} = 100 \times \left[\frac{\text{Larger Number}}{\text{Smaller Number}} - 1 \right]$$

Example – 18

What is the percent increase for $125 and $100?---13=_____%

$$\left[\frac{125}{} \right]$$

Percent Decrease

Equation ➔ $$\%\text{Decrease} = 100 \times \left[1 - \frac{\text{Smaller Number}}{\text{Larger Number}}\right]$$

Example – 19

What is the percent decrease for $125 and $100?--13=_____%

As you have may have noticed the percent increase and percent decrease equations are set up so that the **answers are always positive**. This is a case where one of those rules in the calculator contest may not be quite the same as those taught in the classroom.

There are eight geometry problems of the 2-dimensional and 3-dimensional nature on pages 3, 4, 6 and 7. Typical geometric figures would be circles, squares, triangles (isosceles, equilateral, right, scalene), rectangles, rhombus, parallelograms, trapezoids, cubes, rectangular boxes, spheres, right cylinders, right cones and square-base pyramids.

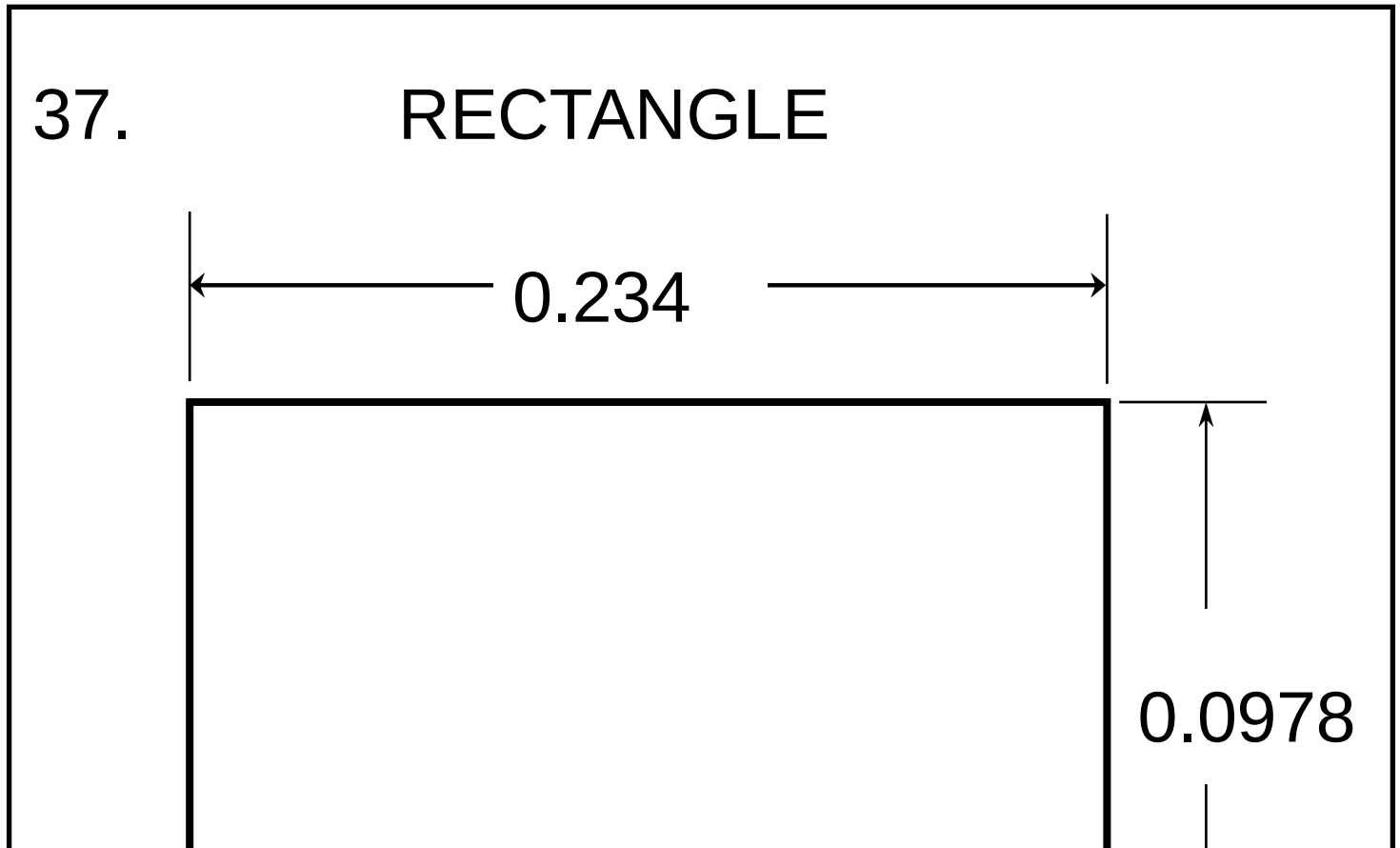
All the formulas you will need are currently on pages 95 – 100 of the UIL Calculator Applications Contest Manual.

earlier.

Finally the student should be able to solve geometry problems involving variations of the geometry figures. The student may see problems with hemispheres, three-quarter-circles, figures where a combination of geometric figures are involved such as cone & hemisphere, square & triangle, cube & hemispherical hole, etc

Geometry Problems

Example – 20



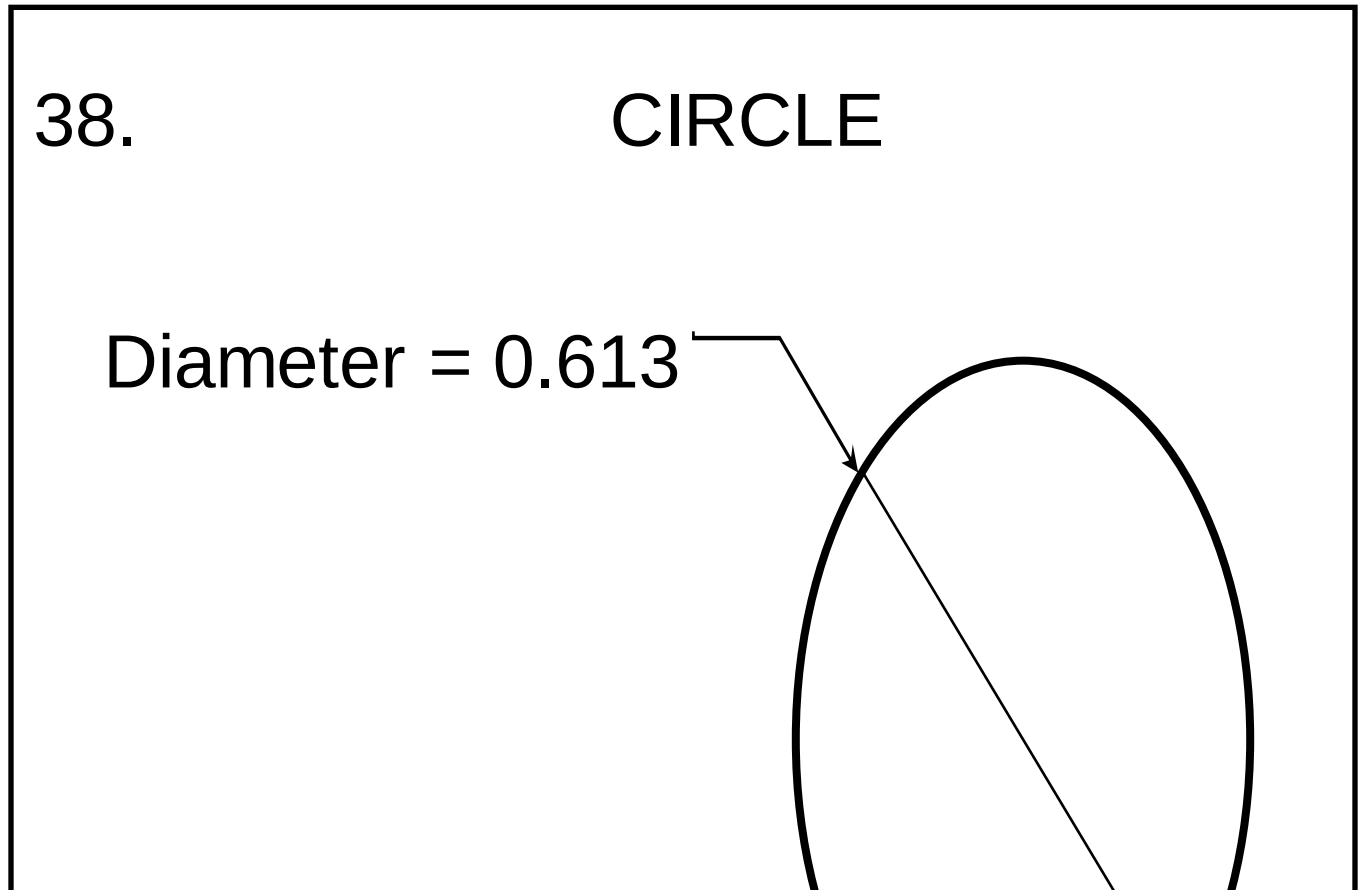
$P = (2)(.234 + .0978)$

$P = 0.6636$

Geometry Problems

Example – 21

38. CIRCLE



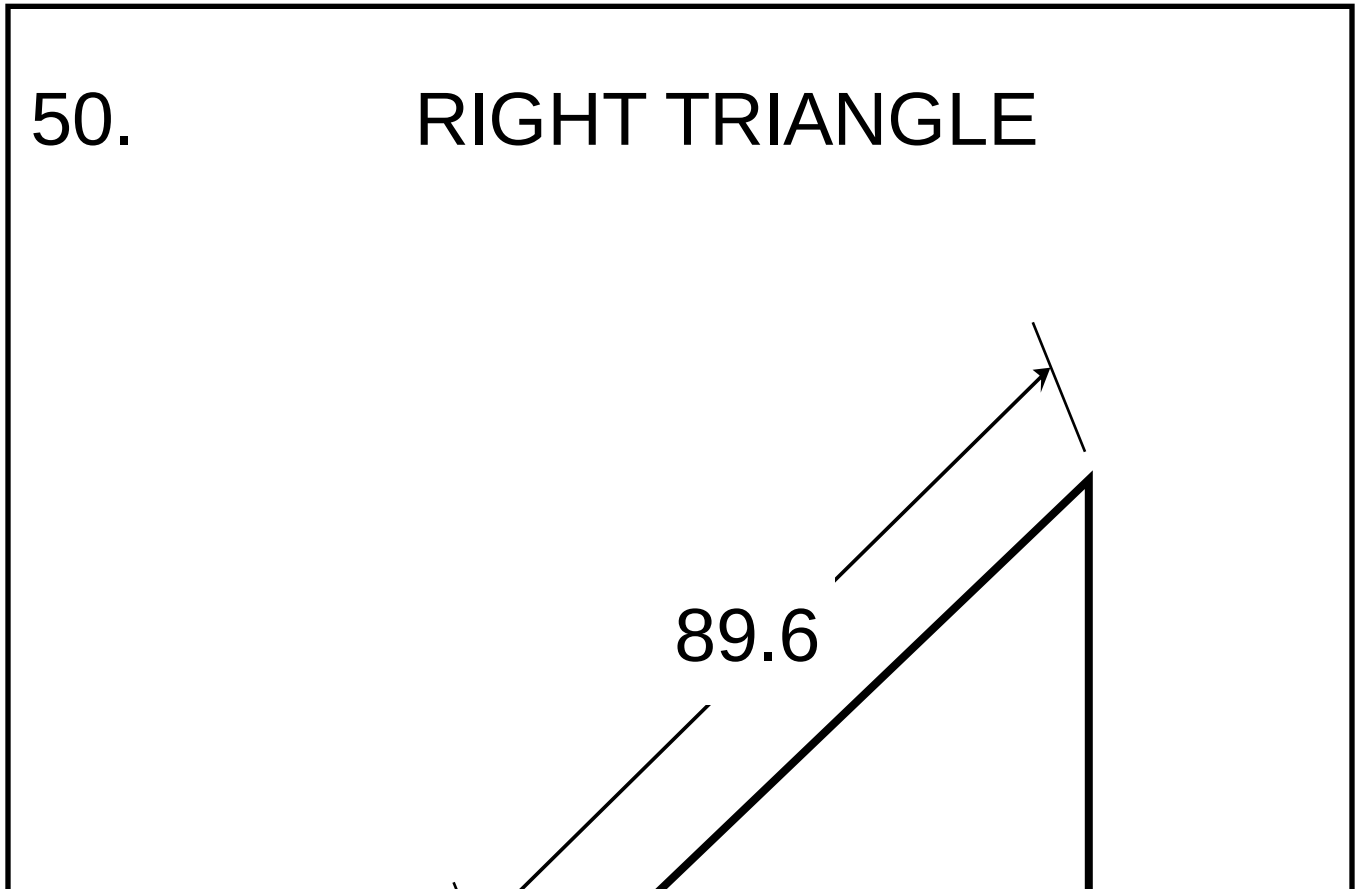
$C = \pi \times (\text{diameter})$

$C = \pi \times (0.613)$

$C = 1.92579 \ldots$

Geometry Problems

Example – 22



Cos? = 75.4/89.6

? = arccos(75.4/89.6)

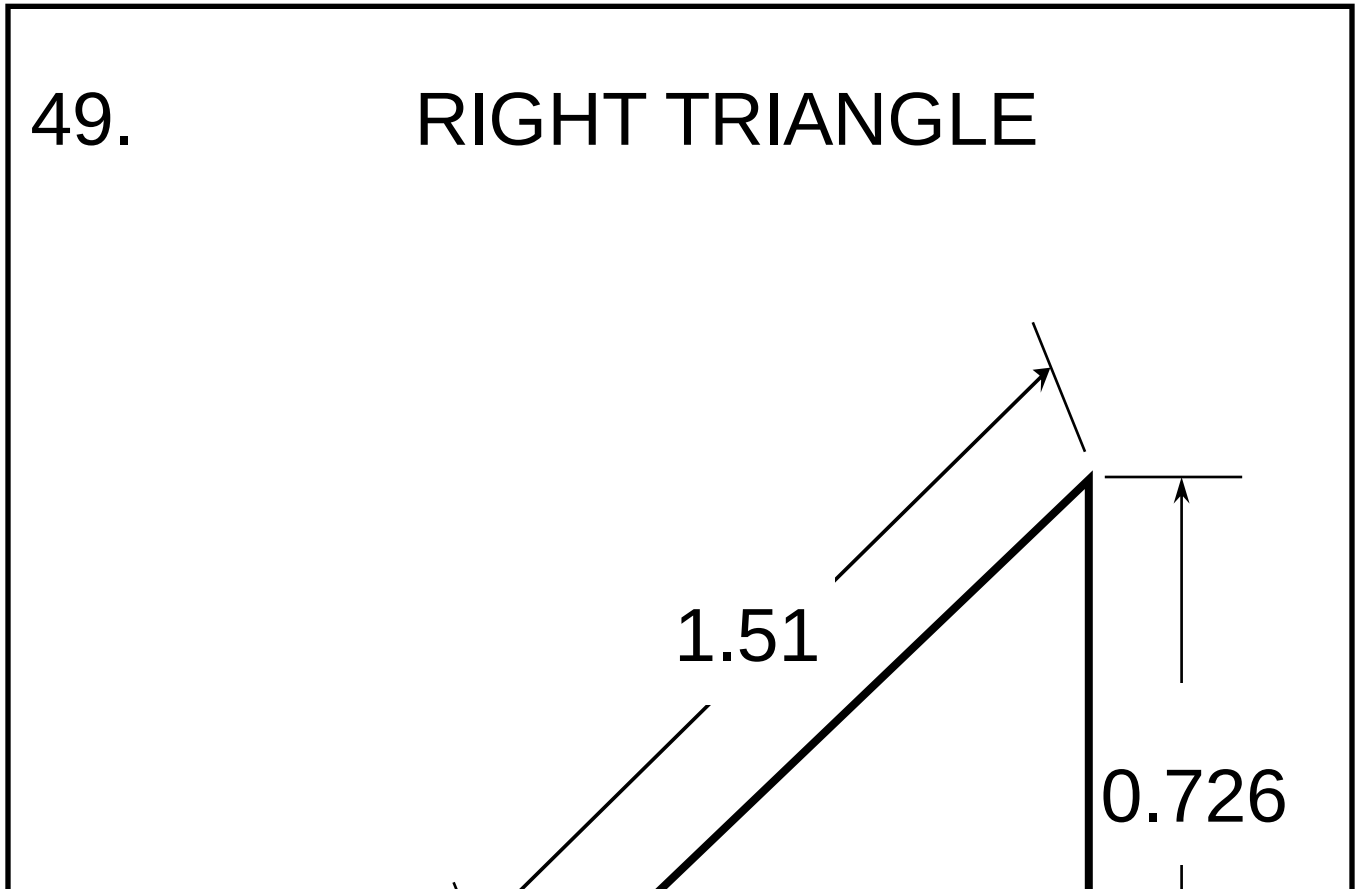
? = 32.6992 . . .

Geometry Problems

Example – 23

$$? = \sqrt{1.52^2 - 0.726^2}$$

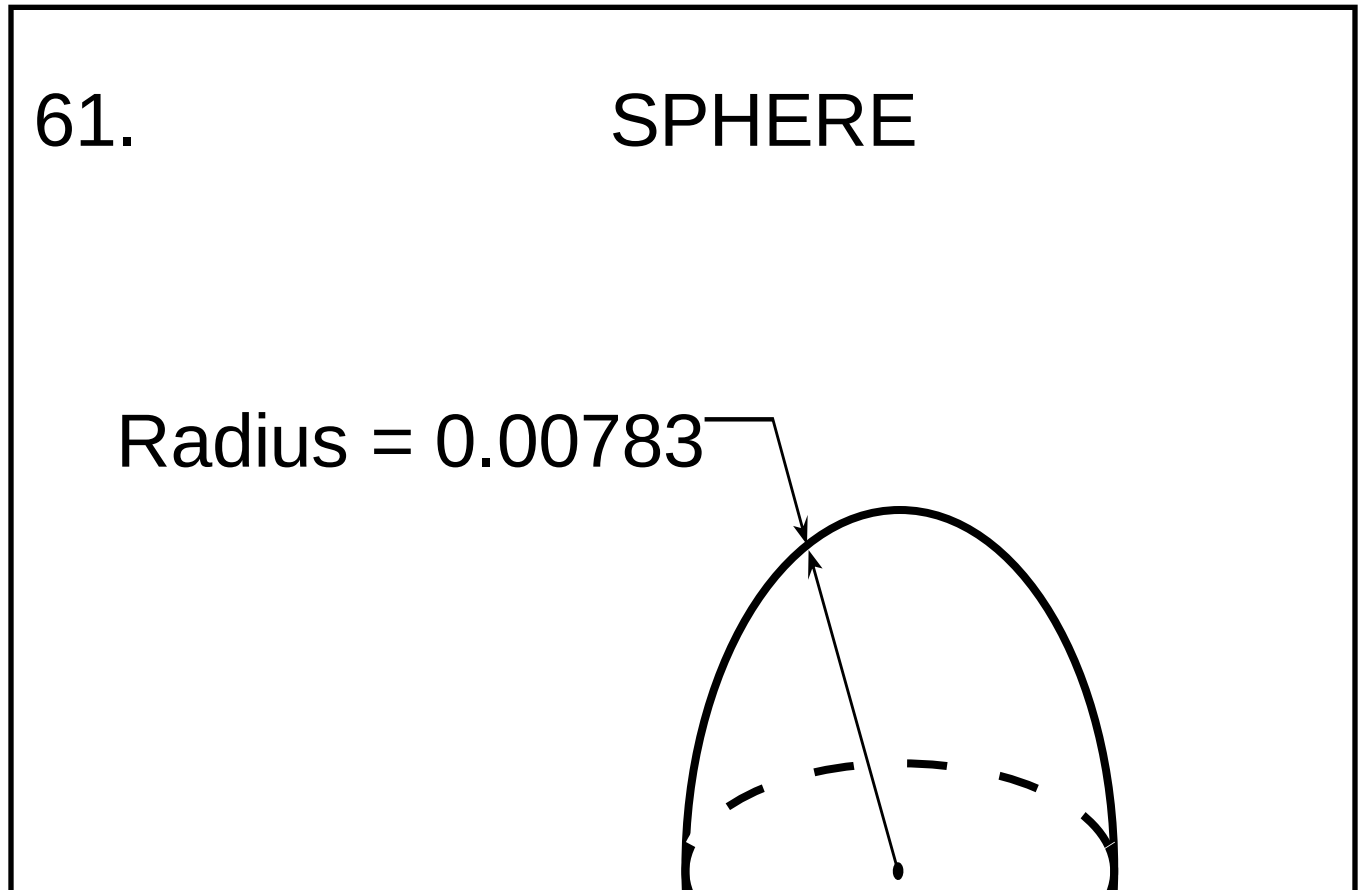
? = 1.3354 . . .



Geometry Problems

Example – 24

61. SPHERE



$SA = 4\pi r^2$

$SA = 4\pi(0.00783)^2$

$SA = 0.00077043 \ldots$

Geometry Problems

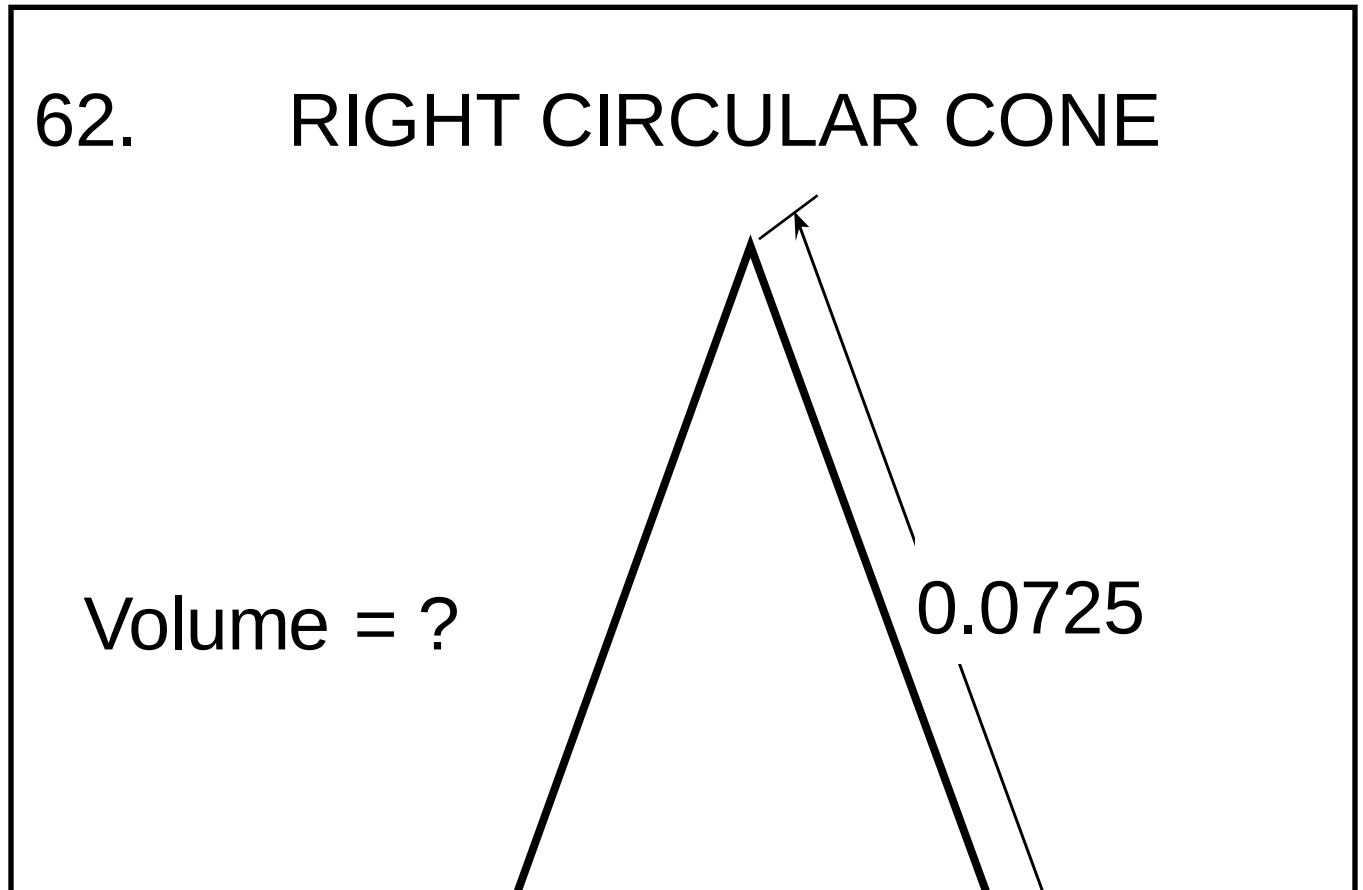
Example – 25

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

$$h = \sqrt{0.0725^2 - 0.0138^2}$$

h = 0.071174 . . .

62. RIGHT CIRCULAR CONE



Geometry Problems

Example – 26

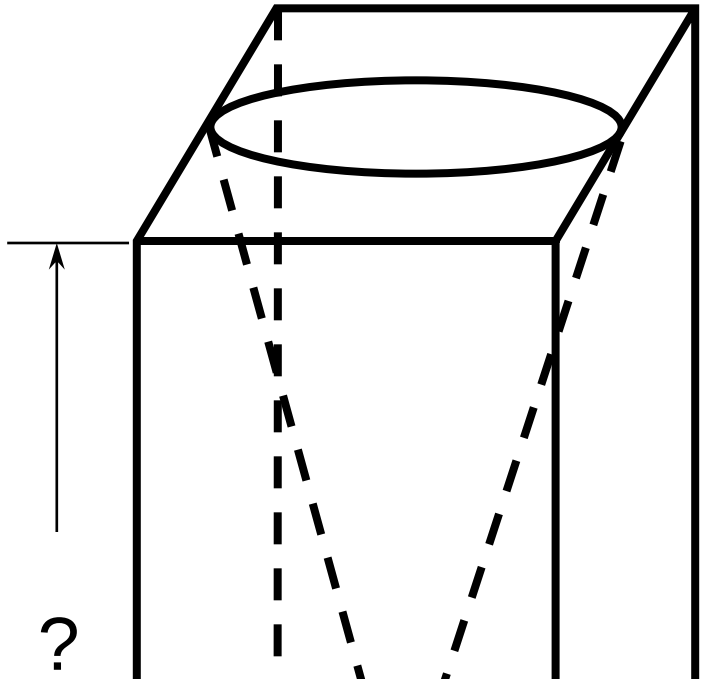
$V_{Remain} = V_{cube} - V_{cone}$

$V_R = ?^3 - (1/3)[\pi(?/2)^2](?)$

$100 = (?^3)[1 - \pi/12]$

$\sqrt{\quad 100}$

74. CUBE, RIGHT CONE CAVITY



Geometry Problems

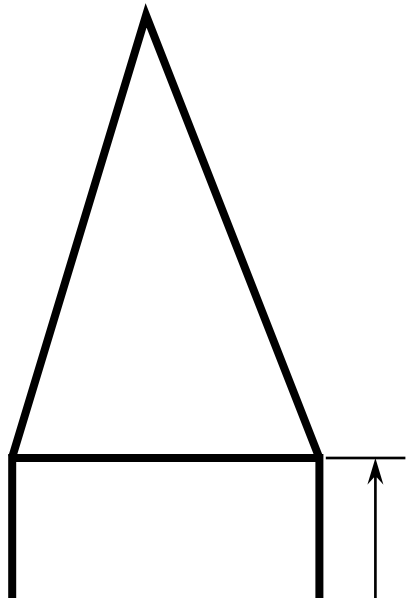
Example – 27

$$A_{Total} = s^2 + \frac{s^2\sqrt{3}}{4}$$

$$A_{Total} = 29400^2 + \frac{29400^2\sqrt{3}}{4}$$

$$A_{Total} = (29400)^2\left[1 + \frac{\sqrt{3}}{4}\right]$$

73. EQUILATERAL TRIANGLE, SQUARE



Practice Problems

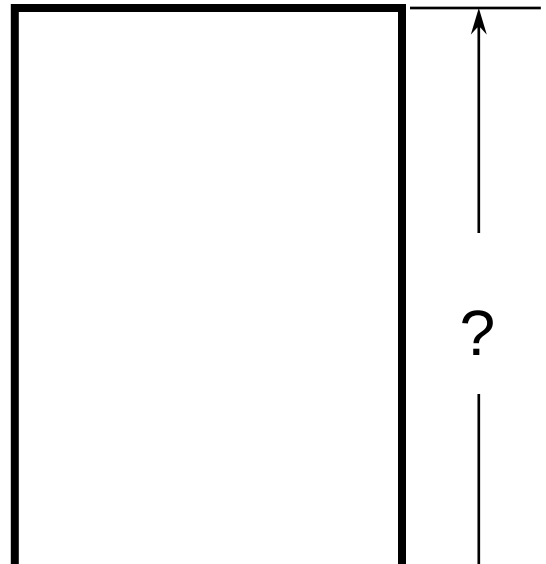
(1) A particular cut of meat cost $3.99 per pound. What is the cost of 1.49 pounds of this meat?----------1=$_____

(2) Cd's at a discounts table cost $2.99 plus 8 ¼ % sales tax. How many CD's can I buy with $50? ----------2=_____Integer

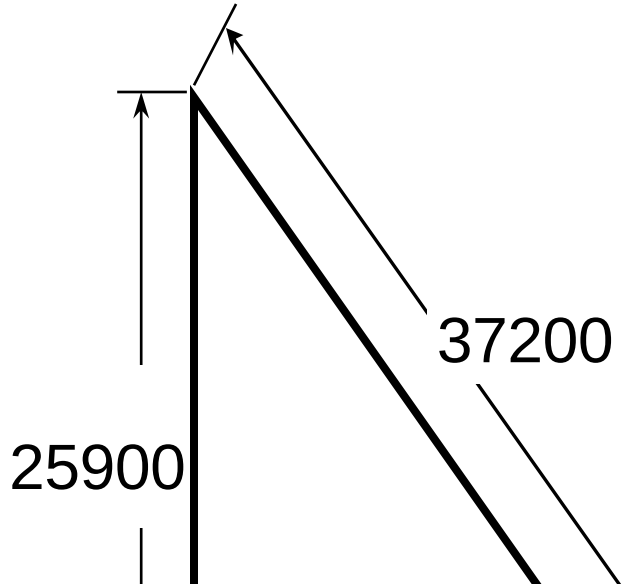
(3) When I turn on my outside faucet I can fill a 64 fluid ounce can in 5.8 seconds with my garden hose. Using the same hose how long would it take me to fill a 55 gallon barrel? ----------3=_____min

Practice Problems

6. Square

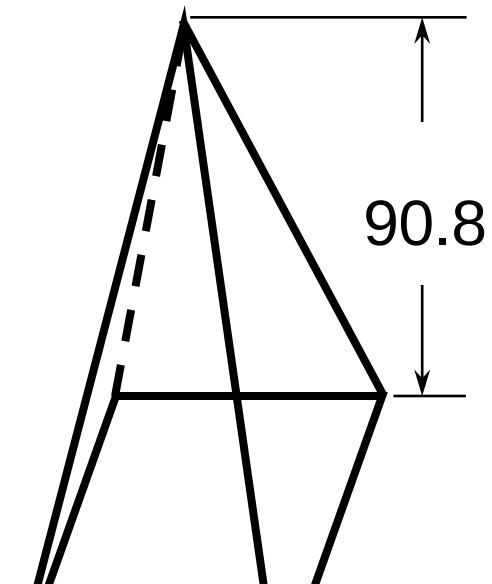


7. RIGHT TRIANGLE

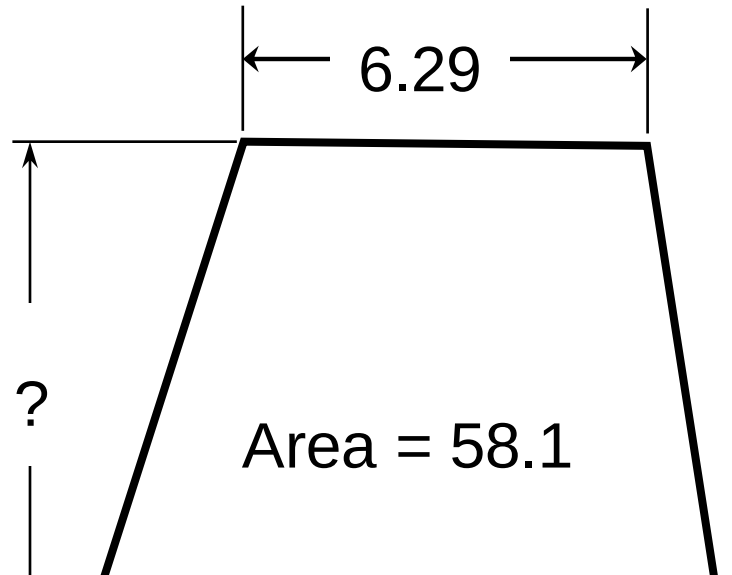


Practice Problems

8. SQUARE PYRAMID

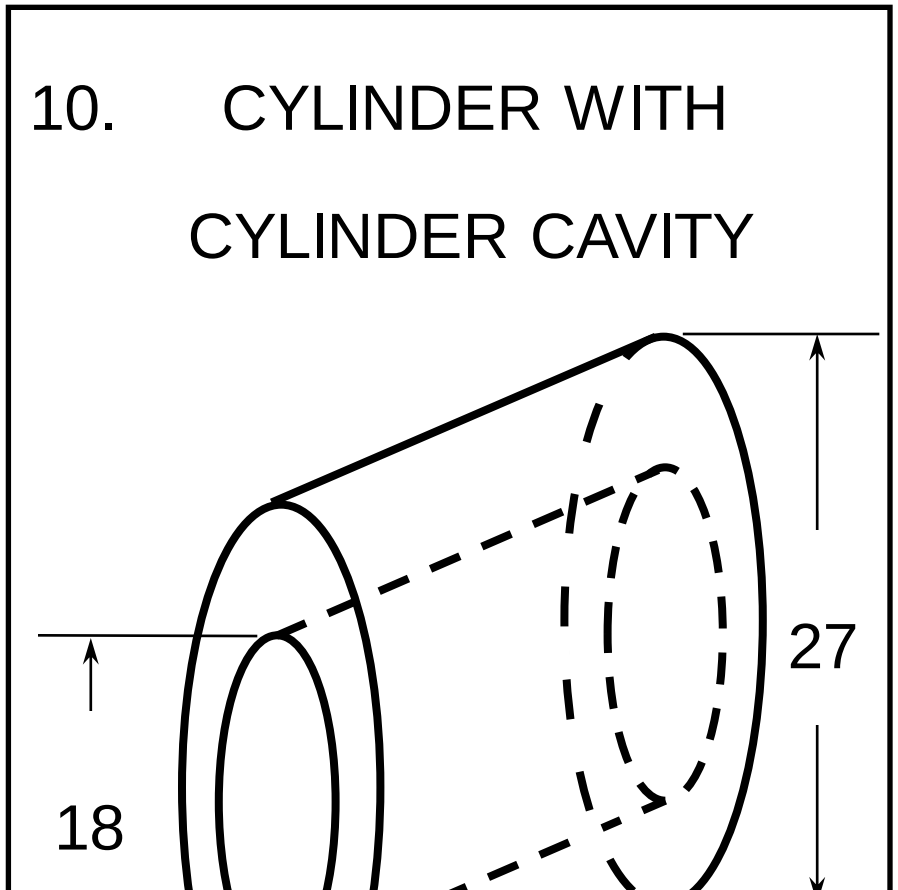


9. TRAPEZOID



Practice Problems

10. CYLINDER WITH CYLINDER CAVITY



Practice Problems Answers

(1) 5.95 (dollar answer)

(2) 15 (Integer)

(3) 10.6 or 1.06×10^{1}

(4) 2.24 or 2.24×10^{0}

(5) 45.6 or 4.56×10^{1}

(6) 0.0379 or 3.79×10^{-2}