RIG MATH REFRESHER

Well Control Training Course

RIG MATH REFRESHER

- Optional course for students registered for IADC Drilling.
- Course taught prior to 3-day Drilling class.
- Review of fundamental well control and rig math along with an emphasis on completing killsheets.
- No additional cost to attend.

COURSE OBJECTIVES

By the end of this workshop, you will be able to confidently perform:

- Area calculations
- Capacity calculations
- Volume calculations
- Open- and closed-end displacement calculations
- Various pressure calculations
- Force calculations
- Buoyancy calculations
- Fluid velocity calculations

INTRODUCTION TO SIGNS & SYMBOLS

- Numerous symbols are used to denote functions of measurement and/or amounts.
- The more common ones will be familiar, but some we come across need to be understood.

INTRODUCTION TO SIGNS & SYMBOLS

What is the small figure at the upper right of a number or letter?

It's called an exponent.

b^2 = b squared = b x b

b^3 = b cubed = b x b x b

INTRODUCTION TO SIGNS & SYMBOLS

BPEMDAS

- Brackets
- Parenthesis
- Exponents
- Multiplication & Division
- Division
- Addition
- Subtraction

Failure to follow this rule can lead to an incorrect answer.

$$4 \times 2^2 + (3 \div 3)$$

$$4 \times 2^2 + 1$$

$$4 \times 4 + 1$$

$$16 + 1$$

$$17$$

AREA

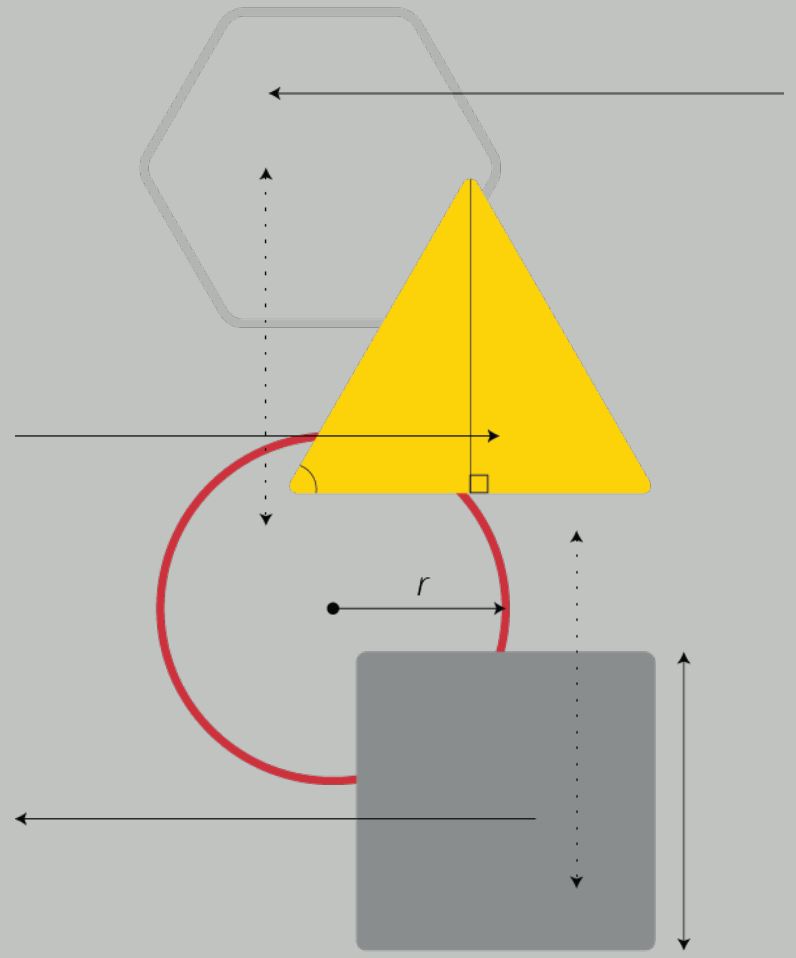
What is area?

- It’s the surface within a defined boundary.

What shape is the boundary?

- Square, rectangular, circular, or any other closed shape.

Units are expressed as squared.



AREA OF A RECTANGLE

To calculate the area of a square or rectangle:

Length x Width

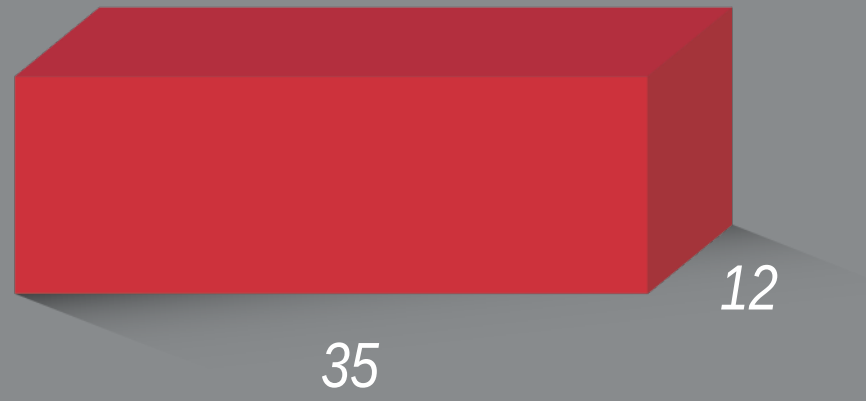
Area = Length x Width

= 18 x 3

= 54 units^2

AREA OF A RECTANGLE

If the base of a tank is 12 ft in width and 35 ft in length, what area would it occupy?



Area = 35 x 12

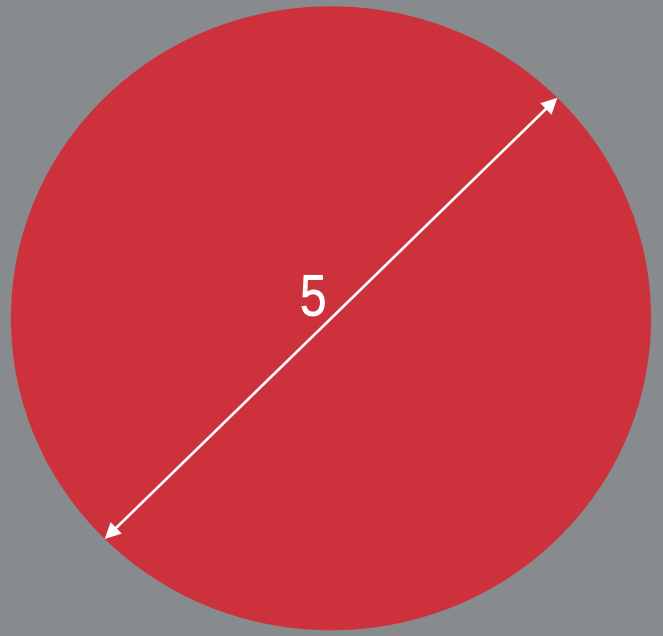
= 420 ft^2

AREA OF A CIRCLE

To calculate the area of a circle:

Area of Circle = $0.7854 \times D^2$

$(0.7854 = \pi / 4)$



Area of Circle = $0.7854 \times D^2$

= 0.7854×5^2

= 0.7854×25

= 19.635 units^2

AREA OF A CIRCLE

Try it!

Calculate the area of a circle with a diameter of 2.50 in.

Area of Circle = $0.7854 \times D^2$

$= 0.7854 \times 2.50^2$

$= 0.7854 \times 6.250$

$= 4.9088 \text{ in.}^2$

AREA OF A CIRCLE

Try it!

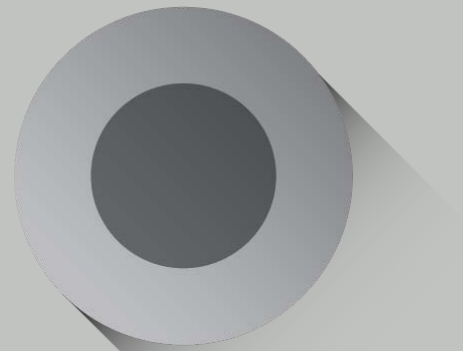
Calculate the area of a circle with a diameter of 4.276 in.

$$\text{Area of Circle} = 0.7854 \times 4.276^2$$
$$= 0.7854 \times 18.284176$$
$$= 14.3604 \text{ in.}^2$$

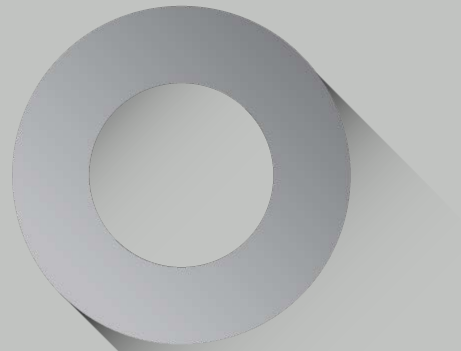
EXPOSED AREA

What are the two most frequently calculated areas?

Closed-end area



Open-end area



EXPOSED AREA

Why do we need to calculate the open-end area?

- Because that may be the area that the pressure is acting on.

When would we use closed-end areas?

- If there is a backpressure valve run in the string, we must calculate for the closed-end area. Failure to do so will lead to incorrect displacement figures.

How do we calculate it?

Open-end area $= 0.7854 \times (OD^2 - ID^2)$

Closed-end area $= 0.7854 \times OD^2$

REMEMBER: When calculating any open-end area, calculate the squares of the two diameters first, then subtract them to find the difference.

EXPOSED AREA

Try it!

Calculate the open-end area at the end of 4-in. tubular with an ID of 3.340 in.

Exposed area $= 0.7854 \times (OD^2 - ID^2)$

$= 0.7854 \times (4^2 - 3.340^2)$

$= 0.7854 \times (16 - 11.1556)$

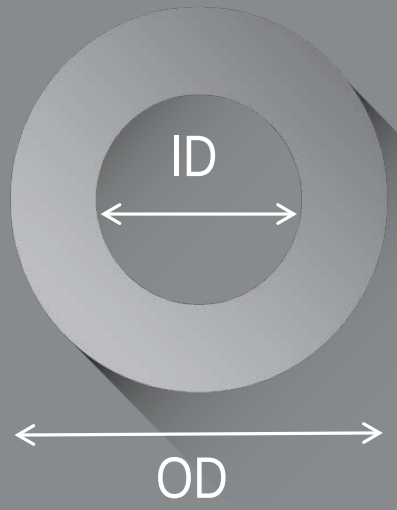
$= 0.7854 \times 4.8444$

$= 3.8048 \text{ in.}^2$

EXPOSED AREA

Try it!

Calculate both the closed- and open-end area of 4.5-in. tubing with an ID of 3.958 in.



Closed-End

Area $= 0.7854 \times 4.5^2$

$= 0.7854 \times 20.25$

$= 15.9044 \text{ in.}^2$

Open-End

Area $= 0.7854 \times (4.5^2 - 3.958^2)$

$= 0.7854 \times (20.25 - 15.67)$

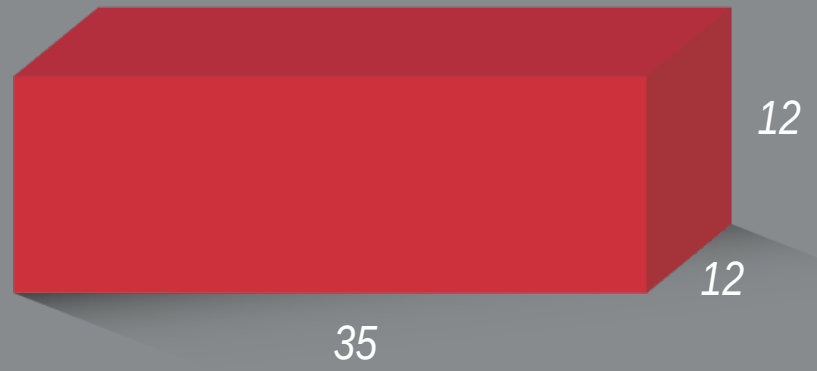
$= 0.7854 \times 4.58$

$= 3.6005 \text{ in.}^2$

VOLUME OF A CUBE/CUBOID

To calculate the volume of a cube or cuboid, we multiply the area of the base by the height:

Volume = Length x Width x Height



The tank mentioned before is 12 ft high and full of water. What volume of water is in the tank?

Volume = 35 x 12 x 12

= 5,040 ft^3

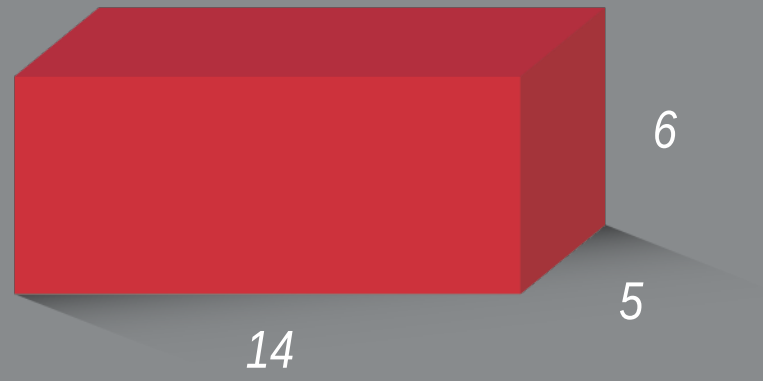
Convert ft^3 to Barrels with 0.178

0.178 x 5,040 ft^3 = 897.12 bbl

CAPACITY OF RECTANGULAR TANK

Capacity is the volume that can be contained within a certain portion.

Typically in the oil field, we will describe capacity as the volume held within a foot in a tubular or tank.



What is the capacity of the tank shown? Answer in barrels per foot.

Capacity = 0.178 x 14 x 5

= 12.46 bbl/ft

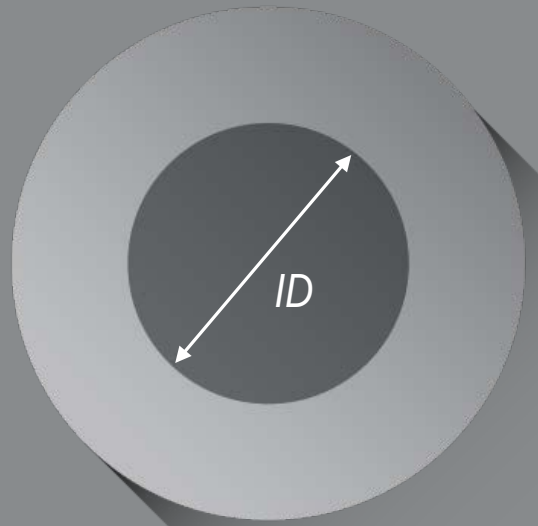
If the fluid level in this tank rose by 2 ft, we would say that we gained (2 x 12.46), or 24.92 bbl.

CAPACITY OF TUBULARS

Use ID to calculate capacity of a tubular or hole:

$$Capacity_{bbl/ft} = ID^2 / 1{,}029.4$$

What is the capacity of 5-in. drillpipe with 4.276-in. ID?



$$\begin{aligned} Capacity &= 4.276^2 \div 1{,}029.4 \\ &= 18.284 \div 1{,}029.4 \\ &= 0.01776 \text{ bbl/ft} \end{aligned}$$

Contact Wild Well Control to learn more about this free Rig Math Refresher Course.

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