



Arithmetic for Rig Personnel

2nd edition



**The University of Texas at Austin
Petroleum Extension Service**

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INTRODUCTION

Skill in identifying problems and skill in handling numbers are required in all arithmetic applications. Both are parts of the *number sense* and are essential for proficiency in using numbers. Number sense can be developed through practice and experience. There are many good Web sites that have detailed explanations of mathematical operations and skill practice.

Routine operations account for most situations where arithmetic is required and calculated by petroleum industry employees. Standard industry procedures are followed for these ordinary daily operations.

The person doing the *counting, measuring, calculating, or recording information* is ultimately responsible for knowing whether the situation is routine or an emergency. While calculators and computers are invaluable, it is the person using them that must have a good understanding of arithmetic to judge if the resulting information is accurate. Accurate calculation and an understanding of what the numbers mean can prevent serious problems.

NOTATION

Symbols in arithmetic are signs used to represent operations, quantities, or relationships. Numerical symbols used in everyday arithmetic are the Arabic numerals 0 through 9 (0,1,2,3,4,5,6,7,8, and 9).

Operation symbols, or signs, include those used to show addition, subtraction, multiplication, division, equal to, and similar functions. The equal sign, for equal to, is used with almost every calculation because it represents the point of separation between the parts of the problem and the resulting answer.

Operation Signs

The operation signs most frequently used in arithmetic are the plus, minus, multiplication, division, and equal signs.

- The *plus sign* (+) indicates addition, the combining of two or more values of like elements to form a sum or total. In the petroleum industry it might be used to add feet to feet, barrels to barrels, or psi to psi. The plus sign also indicates a positive value as opposed to a negative value. It might indicate omitted figures or an approximation; for example, the derrick was 100+ feet in height.
- The *minus sign* (–) denotes subtraction, a number taken away from another number. The result is a *remainder* or a difference. The symbol is read as “less” or “diminished by.” The minus sign also indicates a negative value or loss; for example the average temperature for January was -10°C .

FUNDAMENTAL PROCESSES

Addition

Addition is a form of counting. When doing handwritten calculations, the following suggestions might be helpful.

1. Figures should be uniform in size and legible.
2. Decimal points should be aligned vertically. Put zeros as placeholders to the right of the decimal point if needed to assist in alignment.
3. Decimal place values of ones, tens, and so on should be aligned vertically.
4. To check the answer, reverse the direction in which you added; if you usually start at the top of a column, start at the bottom for checking.

The answer is a sum or a total, in which like units are combined to provide a single number. The following problem shows the correct alignment of numbers for adding by the counting method carrying over numbers to be added in the next column.

$$\begin{array}{r} 222 \\ 4046 \\ 7894 \\ 4321 \\ \underline{6789} \\ 23050 \end{array}$$

Start at the top of the ones column.

- Add the ones column on the right downward. Add the numbers—six, ten, eleven, twenty. The ones column adds up to 20. Write 0 in the ones column and carry the 2 above the tens.
- Add the tens column downward beginning with the 2 carried over—six, fifteen, seventeen, twenty-five. Write 5 below the tens column and carry the 2 above the hundreds column.

CALCULATORS

Calculators are invaluable tools for solving arithmetic problems related to many industrial operations.

Calculators are available in a wide range of capabilities and prices. Simple calculators do basic math functions, square root, percentages, and will have a memory function. Sophisticated scientific calculators can do trigonometric, logarithmic, and graphic functions.

Selecting a Calculator

Select and use a calculator that can quickly perform those operations required by the job. Reading the calculator manufacturer's instructions ensures accuracy and a thorough knowledge of what the calculator can do.

Also, working through some exercises with a calculator increases ease and competence. You should know how to use complex calculator functions before there is an emergency.

The following are practice problems to do with a calculator. Be sure to clear the calculator before starting a new problem.

1. $1.5 + 0.002 + 12.4 = 13.902$

2. $8.02 - 0.015 = 8.005$

3. $1.2 \times 1.8 = 2.16$

4. $42.24 \div 0.66 = 64$

5. $1 \div 7 = 0.1428571$

Using the Calculator

A calculator can only process the information the person enters into it. If the data entered is wrong, the answer will be wrong. The employee must have sufficient mathematical competence to recognize

FRACTIONS

Common Fractions

Common fractions such as halves, thirds, fourths, sixteenths, and sixty-fourths are frequently used in field operations in the petroleum industry. Examples of the fundamental process using common fractions are shown below.

Addition:

1. $\frac{1}{4} + \frac{3}{64} = \frac{19}{64}$ requires a common denominator

$$\frac{1}{4} \times \frac{16}{16} = \frac{16}{64} \quad \text{and} \quad \frac{3}{64} = \frac{3}{64}$$

$$\text{therefore } \frac{16}{64} + \frac{3}{64} = \frac{19}{64}$$

2. $3\frac{5}{8} + 6\frac{1}{2} = 10\frac{1}{8}$ requires a common

denominator

$$3\frac{5}{8} = 3\frac{5}{8} \quad \text{and} \quad 6\frac{1}{2} = 6\frac{4}{8}$$

$$\text{therefore } 3\frac{5}{8} + 6\frac{4}{8} = 10\frac{1}{8}$$

Subtraction:

1. $5\frac{1}{8} - 3\frac{3}{4} = 1\frac{3}{8}$ requires a common denominator

$$5\frac{1}{8} = 4\frac{9}{8} \quad \text{and} \quad 3\frac{3}{4} = 3\frac{6}{8}$$

$$\text{therefore } 4\frac{9}{8} - 3\frac{6}{8} = 1\frac{3}{8}$$

2. $\frac{3}{4} - \frac{2}{5} = \frac{7}{20}$ requires a common denominator

$$\frac{3}{4} = \frac{15}{20} \quad \text{and} \quad \frac{2}{5} = \frac{8}{20}$$

$$\text{therefore } \frac{15}{20} - \frac{8}{20} = \frac{7}{20}$$

FORMULAS AND PROBLEMS

When using a calculator, the problem must be correctly stated in a formula with the numbers and operation signs in the proper sequence to get the required answer. Most mathematical formulas begin with the desired unit and must be restated or written in a sequence to end with the desired answer.

The following formulas and problems show how a calculator is used to simplify arithmetic for petroleum operations.

Hydrostatic Pressure Relationships

To calculate hydrostatic pressure, mud weight, or true vertical depth, several formulas are commonly used.

Formula 1: $C \times Wt \times TVD = P$

Formula 2: $\frac{P}{TVD \times C} = Wt$ or $P \div TVD \div C = Wt$

Formula 3: $\frac{P}{Wt \times C} = TVD$ or $P \div Wt \div C = TVD$

Formula 4: $\frac{P}{Wt \times TVD} = C$ or $P \div Wt \div TVD = C$

where

C is constant (0.052 for pounds per gallon; 0.007 for pounds per cubic foot)

Wt is mud weight in pounds per gallon (ppg) or pounds per cubic foot (pcf)

TVD is true vertical depth in feet (ft)

P is hydrostatic pressure in pounds per square inch (psi)

OTHER CALCULATOR CAPABILITIES

The operating instruction manual furnished by the manufacturer with the calculator will describe other functions that can be performed on it. Most calculators can also do square roots and powers.

Problem 1—Find the square root of 42.25.

Using a calculator, the problem should be worked as follows:

Enter	Calculator Display
42.25	42.25
$\sqrt{\quad}$	6.5

The square root of 42.25 = 6.5

Problem 2—Find the sixth power of 10 or 10^6 .

Using a calculator, the problem should be worked as follows:

Enter	Calculator Display
10	10
×	10
=	100
×	10
=	1,000
×	10
=	10,000
×	10
=	100,000
×	10
=	1,000,000

The sixth power of 10 = 1,000,000

Note that there are now six zeros after the one.

Your calculator may have a button on it that allows you to raise numbers to a power. This button normally

To obtain additional training materials, contact:

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