

Automotive Technology (47.0604) T-Chart

Measure wheel, tire, axle flange and hub run out;
Determine necessary action

Program Task: Measure wheel, tire, axle flange, brake drum and hub run out to determine necessary action.

Program Associated Vocabulary:
FRACTIONAL, DECIMAL, MEASURED IN THOUSANDTHS OF AN INCH

Program Formulas and Procedures:
Automotive technicians work daily with both decimal and fractional inch dimensions. The ability to recognize size relationships between these dimensioning systems is crucial because parts and measuring devices frequently use both.

Example:
A part requires the following hole diameters to be drilled in a row from smallest to largest. Order the drill sizes from smallest to largest.

$7/32$.625 $11/16$.201 $3/8$

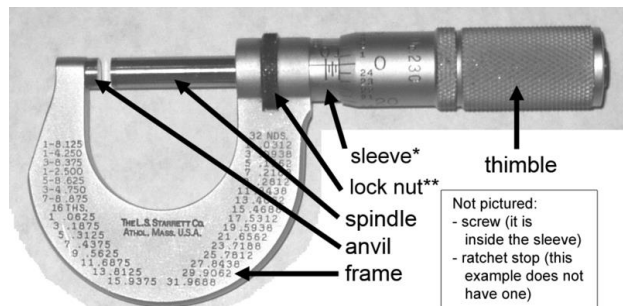
Convert the fractions to decimal form:
 $7/32 = .2188$, $.625$, $11/16 = .6875$, $.201$, $3/8 = .375$

Then order from largest to smallest:
 $.201$, $7/32 = .2188$, $3/8 = .375$, $.625$, $11/16 = .6875$

Example:
The largest diameter of a splined wheel stud to produce on a lathe is .288 inches. Bar stock is available in $1/16$ " diameter increments. What diameter is needed for the project?

One method of solving this problem is to list fractions in $1/16$ increments along with their decimal equivalents and then see which fraction is closest to and larger than .288.
($4/16 = .25$ and $5/16 = .3125$)

So, $5/16$ " diameter material is needed.



*Sleeve is the most prevalent name. May also be called the barrel or stock.
**Aka lock-ring. Some mics have a lock lever instead.

Apply properties of rational and irrational numbers to solve real world problems

PA Core Standard: CC.2.1.HS.F.2

Description: Apply properties of rational and irrational numbers to solve real world or mathematical problems.

Math Associated Vocabulary:
REAL NUMBER, RATIONAL NUMBER, IRRATIONAL NUMBER, DECIMAL, FRACTION, SQUARE ROOT

Formulas and Procedures:
It is relatively simple to compare numbers when they are in the same form. For example 0.15 is smaller than 0.25. The numbers are both in decimal form so are easily comparable.

It becomes more difficult to compare numbers that are either in different forms, such as a fraction to a decimal, or in fractional form with different denominators, such as $3/5$ and $5/9$.

The easiest way to compare numbers that are in different forms is to convert each number to its decimal form.

Example: Which of the following numbers is largest?

$6/25$ $3/14$ 0.2

- Convert each number to its decimal equivalent:
 0.24 $0.2142857...$ 0.2
- Compare the digits in the tenth place, if they are the same move to the hundredths place, and so on until the order can be determined.

For instance, we cannot round to the nearest tenth, because it would give us the same value of .2 for all of the numbers.

Rounding to the nearest hundredth would make the numbers:

0.24 0.21 0.2

- Add zeroes to make all numbers have the same number of digits after the decimal.

0.24 0.21 0.20

For comparative purposes, it is important to add a zero so that the numbers $20/100$, $21/100$, and $24/100$ can be compared.

Since $24/100$ is larger than $21/100$ and $20/100$, 0.24 ($6/25$) is the largest number.

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Instructor's Script - Comparing and Contrasting

These examples in the automotive technology field show the importance of the PA Core standard concept of comparing and ordering real numbers. In some careers people will work mostly with either decimals or with fractions, but in this trade area people work with and compare both types of numbers. There are also examples in other T-charts where the students need to work with irrational numbers and compare and order these numbers.

Common Mistakes Made By Students

Comparing decimals: Decimals are easier to compare if the number of digits after the decimal point is the same. For instance, students often think that 0.6 is less than 0.34 because 6 is less than 34. A zero must be added to the 6 to make the number .60 so that the student can compare 0.60 and 0.34

Comparing fractions: Fractions can be compared when they have a **common denominator**. For instance, 5/16 inches and 3/8 inches are two measurements on a ruler. In order to compare the two fractions, they must have a common denominator, 16. 3/8 is larger than 5/16.

$$\frac{3}{8} = \frac{\quad}{16} \qquad \frac{3 \times 2}{8 \times 2} = \frac{6}{16}$$

CTE Instructor's Extended Discussion

Another situation involving comparing decimal and fractional dimensions is related to cutting tools. Tool diameters are normally available in only fractional sizes, so the technician must know what fractional size tools are needed to produce decimal dimensions.

Example: A .835 inch deep inset must be machined into a wheel hub. Since end mills are only available in 1/16" diameter increments, what is the largest diameter end mill that can be used to machine the slot?

This is similar to the bar stock sample, except that in this case the nearest 1/16" **smaller** than .835 is needed.

Further, another method that can be used to solve the problem is to use a proportion instead of listing fractions.

$$.835 = 835/1000$$

$$\frac{835}{1000} = \frac{x}{16}$$

$$835(16) = 1000x$$

$$13360 = 1000x$$

$$x = 13.36$$

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Problems	Career and Technical Math Concepts	Solutions
1. Sort the following diameters wheel studs from smallest to largest for organization in the parts room: $1/2$ $7/16$ $5/16$ $5/8$ $9/3$		
2. A rotor requires .105 of material to be machined from its front surface to make it true. If a brake tool's units are in $1/32$ " width increments, what is the maximum setting that can be used?		
3. An existing part has a 10mm (.394") diameter hole. The hole must be reproduced in another part with the closest $1/64$ " size drill but cannot be smaller than the hole in the original part. What size drill can be used to produce the hole?		
Problems	Related, Generic Math Concepts	Solutions
4. Which of the following measurements is longest? $2\ 1/2$ inches, $2\ 3/8$ inches, $2\ 7/16$ inches		
5. Order the following measurements from least to greatest: $\sqrt{7}$ feet, $2\ 1/2$ feet, 2.6 feet		
6. Which of the following measurements is longest? 2π cm., $\sqrt{41}$ cm., 6.25 cm.		
Problems	PA Core Math Look	Solutions
7. Order the following numbers from least to greatest: 2.4, $\sqrt{5}$, $2\ 7/8$		
8. Order the following numbers from least to greatest: $\sqrt{10}$, π , $3\ 1/5$, 3.2		
9. Order the following numbers from largest to smallest: 0.02, 0.223, 0.24, 0.243		

