

## Math 229: DMS Supplement

### Degrees: Decimal form vs. DMS form

The concept of measuring angles in *degrees* grew out of the belief of the early Babylonians that the seasons repeated every 360 days. One degree is the measure of an angle formed by rotating a ray (one three hundred sixtieth) of a complete revolution.

There are two popular methods for representing degrees and their fractional parts. One is the decimal degree method. For example, the measure  $29.76^\circ$  is a decimal degree. It means

$29^\circ$  plus 76 hundredths of  $1^\circ$

A second method of measurement is known as the DMS (Degree, Minute, Second) method. For example, the measure  $126^\circ 12' 27''$  is a degree value expressed in DMS form. It means

$126^\circ$  plus 12 minutes plus 27 seconds

In the DMS method the fractional part of a degree may be expressed by understanding that we subdivide a degree into 60 equal parts, each of which is called a minute (denoted by ') and that a minute is subdivided into 60 equal parts, each of which is called a second (denoted by ").

Thus  $1^\circ = 60'$ ,  $1' = 60''$ , and  $1^\circ = 3600''$ .

**Changing Minutes and Seconds to Decimal Degrees:** It is sometimes necessary to change minutes or seconds to decimal equivalents or vice versa. Minutes or seconds are first changed to their fractional part of a degree. Then the fraction is changed to its decimal equivalent by dividing the numerator by the denominator.

### Angle Calculations

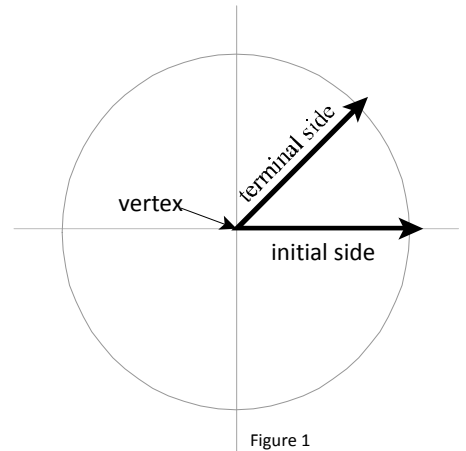
- To change minutes to a decimal part of a degree: **Divide minutes by 60.**
- To change seconds to a decimal part of a degree: **Divide seconds by 3600.**

**For example:** Convert  $50^\circ 15' 27''$  to a decimal degree value.

Change  $15'$  to its decimal degree equivalent .

Change  $27''$  to its decimal degree equivalent.

And then add the values together:



**Changing a Decimal Degree into a DMS Degree Value:** The decimal part of a degree can be changed to minutes and seconds by reversing the procedure. To change a decimal part of a degree to minutes, multiply by 60. Similarly, to change the decimal part of a minute to seconds, multiply by 60.

- *To change a decimal part of a degree to minutes: **Multiply the decimal part of a degree by 60.***
- *To change a decimal part of a minute to seconds: **Multiply the decimal part of a minute by 60.***

**For example:** Convert  $50.75^\circ$  into a DMS degree value

Change  $0.75^\circ$  to minutes

And so...

**For example:** Convert  $28.43^\circ$  into a DMS degree value

Change  $0.43^\circ$  to minutes and seconds

*(degrees to minutes)*

*(decimal part of min to sec)*

And so...

**Adding and Subtracting Angle Measures:** Angle measures can be added or subtracted. Keep in mind that only like measures can be added or subtracted.

**To add,** arrange the measures in columns of like measures.

**For example:** Add  $12^\circ 15' 54'' + 82^\circ 28' 19''$

**To subtract**, arrange the measures in columns of like measures; borrow as needed.

**For example:** Subtract:  $37^{\circ} 15' - 15^{\circ} 32'$

**Complementary & Supplementary Angles:** If the sum of the measures of two angles equals one straight line ( $180^{\circ}$ ), the angles are called supplementary. If the sum of the measures of two angles equals one right angle ( $90^{\circ}$ ), the angles are called complementary. To find the complement of any angle, subtract the angle from  $90^{\circ}$ ; to find the supplement of any angle, subtract the angle from  $180^{\circ}$ .

**For example:** Find the complement of  $63^{\circ} 37'$ .

**Multiplying and Dividing Angle Measures:** To multiply or divide angle measures, perform the indicated operation and simplify as needed.

**For example:** An angle whose measure is  $65^{\circ} 02' 37''$  needs to be twice as large. Find the measure of the new angle.

**Math 229: Homework for DMS Supplement:** Do these 14 problems on a separate paper (showing work) and include in homework set 1.

Perform the indicated operations. Be sure to simplify your final answers.

1. Change  $0.42^\circ$  to equivalent minutes and seconds.
2. Change  $15^\circ 4'$  to its decimal degree equivalent rounded to the nearest ten-thousandth.
3. Change  $0.46^\circ$  to equivalent minutes and seconds.
4. Change  $8^\circ 20'$  to its decimal degree equivalent rounded to the nearest ten-thousandth.
- 5) Add and simplify:  
$$\begin{array}{r} 15^\circ 47' 18'' \\ + 37^\circ 12' 45'' \\ \hline \end{array}$$
- 6) Subtract and simplify:  
$$\begin{array}{r} 147^\circ 28' \\ - 114^\circ 35' 23'' \\ \hline \end{array}$$
- 7) Add and simplify:  $45^\circ 10' 14'' + 7^\circ 8' 55''$
- 8) Subtract and simplify:  $32^\circ 6'' - 20^\circ 10' 8''$
9. Find the measure of an angle with a complement of  $35^\circ$ .
10. Find the measure of an angle with a supplement of  $35^\circ$ .
11. An angle whose measure is  $17^\circ 36' 40''$  needs to be three times as large. Find the measure of the new angle in degrees and minutes.
12. An angle whose measure is  $45^\circ 37' 30''$  needs to be twice as large. Find the measure of the new angle in degrees and minutes.
13. A right angle will be divided into four equal angles. Find the measure of each new angle in degrees and minutes.
14. Find the complement of  $40^\circ 37' 26''$ . Then convert the result to its decimal equivalent rounded to the nearest ten-thousandth.

ANSWER KEY

1.  $25' 12''$       2.  $15.0667^\circ$     3.  $27' 36''$     4.  $8.3333^\circ$     5.  $53^\circ 3''$     6.  $32^\circ 52' 37''$   
7.  $52^\circ 19' 9''$     8.  $11^\circ 49' 58''$     9.  $55^\circ$     10.  $145^\circ$     11.  $52^\circ 50'$     12.  $91^\circ 15'$   
13.  $22^\circ 30'$     14.  $49.3761^\circ$