

True North Azimuth —> Magnetic North Azimuth



The National Geophysical Data Center (NGDC) has an online Magnetic Declination Calculator at:
<http://ngdc.noaa.gov/geomag-web>

If you know the true north azimuth between two locations, it is a simple matter of adding or subtracting the magnetic declination to the true north azimuth.

Abbreviations:

MagDec	: Magnetic Declination - Degrees
AZ_TN	: Azimuth True North - Degrees
AZ_MN	: Azimuth Magnetic North – Degrees
MN	: Magnetic North
TN	: True North
ABS()	: Absolute Value
<	: Less than
>=	: Greater than or equal

Algorithm:

If MagDec < 0 (WEST) Magnetic Declination is west of 0.0 degrees true north
 $AZ_MN = AZ_TN + ABS(MagDec)$ **or** $AZ_MN = AZ_TN - (-MagDec)$

If MagDec >= 0 (EAST) Magnetic Declination is east of 0.0 degrees true north
 $AZ_MN = AZ_TN - MagDec$

Example:

AZ_TN = 090
MagDec = -7.00 (WEST)
 $AZ_MN = AZ_TN + ABS(MagDec)$ **or** $AZ_MN = AZ_TN - (-MagDec)$
097 = 090 + ABS(-7.00) **or** 097 = 090 - (-7.00)

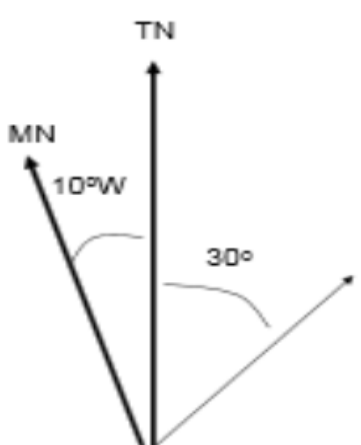
AZ_MN = 097 degrees

If AZ_MN < 0 then AZ_MN = 360 + AZ_MN
If AZ_MN >= 360 then AZ_MN = AZ_MN – 360

References:

<http://www.geog.ucsb.edu/~archer/Geog12/Lecture11.pdf>

Declination WEST



Magnetic north is 10 degrees west of true north

To correct a TRUE bearing (e.g. 30) to MAGNETIC, We need to rotate counterclockwise to correct

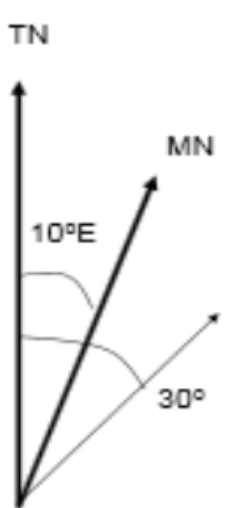
So declination is ADDED to the magnetic bearing

WEST IS BEST, SO ADD
 $30 + 10 = 40$

For magnetic to true, do the opposite (SUBTRACT)

Note: The above picture denotes the Magnetic Declination as +10 degrees west.
Decimal magnetic declinations west of 0.0 degrees true north (TN) are negative, i.e., -10 degrees.
Decimal magnetic declinations east of 0.0 degrees true north (TN) are positive, i.e., +10 degrees.

Declination EAST



Magnetic north is 10 degrees east of true north

To correct a TRUE bearing (e.g. 30) to MAGNETIC, We need to rotate clockwise to correct

So declination is SUBTRACTED from the true bearing

EAST IS LEAST, SO SUBTRACT
 $30 - 10 = 20$

For magnetic to true, do the opposite (ADD)

The magnetic reference for Earth is north regardless of whether you are traveling north or south. Magnetic declination, or declination, is the difference between the true north reading from the map and the magnetic north reading from a compass. When a compass is used in combination with a map, a correction must be made to allow for declination.

In North America, magnetic declination varies from 30 degrees East in Alaska to 20 degrees West in Labrador, Maine. The degrees of declination for an area are usually located on the bottom margin of the map near the north arrow, or they can be located using a declination chart.

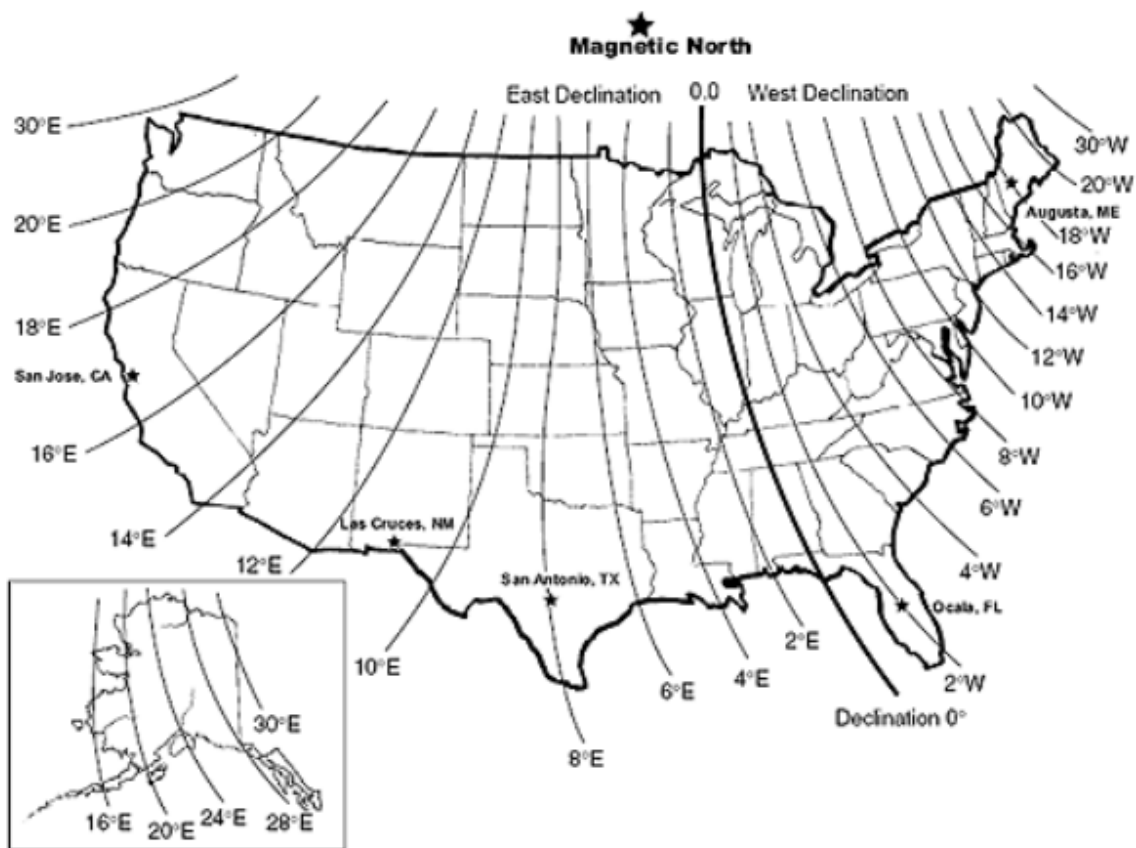
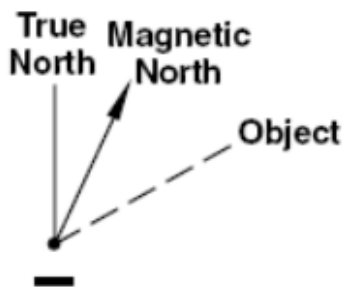


Figure 6.2—Map shows declination of the compass in North America.

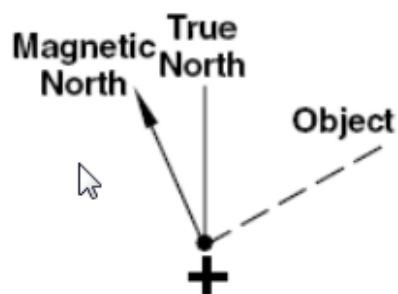
The method for correcting for declination is as follows:

1. For Easterly Declination, subtract the declination from the true reading to obtain the magnetic reading. Magnetic = true - easterly declination
2. For Westerly Declination, add the declination to the true reading to obtain the magnetic reading. Magnetic = true + westerly declination

An easy way to remember whether to add or subtract is "West is best and East is least." So for West declination, add to the true reading (West is best, and therefore a larger number) and for East declination subtract from the true reading (East is least, and therefore a smaller number).



If the arrow on the compass is to the right of true north, or to the east, **subtract** the declination.

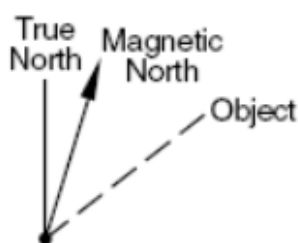


If the arrow on the compass is to the left of true north, or to the west, **add** the declination.

Example 1 - Paloma is in San Jose, California. The declination is 17°E. Paloma's compass reading from her current location to the mountain range to which she is traveling is 35°. What is her true reading?

Step 1. The declination of 17°E is an **easterly declination**.

Step 2. In this case, True - east = magnetic according to the "East is least" guideline above, so we will solve the equation for the true reading and find that true = magnetic + east. We must **add** the declination to go from the magnetic reading on the compass to the true reading.



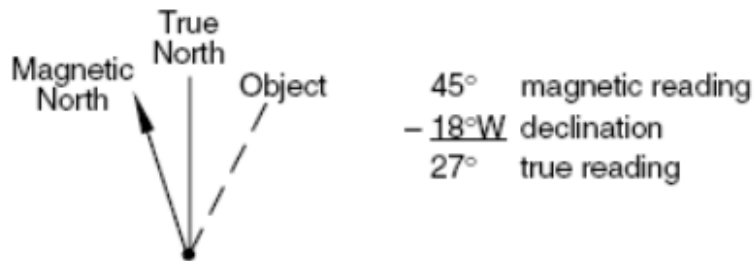
35° magnetic reading
+ 17°E declination
52° true reading

Paloma's true reading is 52 degrees.

Example 2 - Sonia is in Augusta, Maine. She has a compass with a magnetic north reading of 45° . What is her true reading on a map?

Step 1. Look up the declination for Augusta, Maine, on a declination chart. Maine has a declination of 18°W .

Step 2. Because 18°W is a westerly declination, remember "West is best" and that the magnetic = true + west. In this case, to solve for the true reading, we must subtract the declination from the magnetic bearing: true = magnetic - west.



Sonia's true reading is 27 degrees.

When traveling in an opposite direction and adjusting map readings for use with compass readings, do the opposite of the above for adding and subtracting the declination.

Example 3 - Roger looks at a map and takes an azimuth reading of 85° , a true reading, off the map from where he is standing to the location of a tower. The declination for the area is 12°E . What is the magnetic reading?

Step 1. In order to find the magnetic reading by using a compass, subtract the easterly declination. Remember, "East is least."

$$85^\circ - 12^\circ = 73^\circ$$

Roger's magnetic reading is 73 degrees.