CALCULATE EARTH ROTATION SPEED AT YOUR LATITUDE

Motion	km/hr	km/sec	mi/hr	mi/sec	Direction
Earth Rotation	1,670	0.5	1,037	0.3	East Counterclockwise**

**Counterclockwise looking down on the North Pole of Earth

Looking down on the North Pole, our Earth rotates counterclockwise. If you stand on the Equator, you will be traveling the speed shown above; if you stood directly over the North or South Pole, your orbital speed would be about zero. Mathematically, you would need to be an infinitesimal line with the Earth's axis to be traveling at zero, since an infinitesimal line does not spin.

You would slowly spin on our Earth's axis at the North or South Poles. But with your eyes a short distance from the axis of the pole, you would see your orbital speed move about 1 inch or 2.5 cm per 24 hours. And it would be cold.

Numbers needed

Earth circumference at Equator: 40,070 kilometers = 24,883 miles
Earth day: 24 hours

$$\frac{Earth\ circumference}{Earth\ day} = Earth\ rotation\ speed$$

$$\frac{40{,}070\ \text{km}}{24\ \text{hrs}} = 1670\ \text{km/hr}$$

$$\frac{24{,}883\ \text{mi}}{24\ \text{hrs}} = 1037\ \text{mi/hr}$$

Then Earth Rotation Speed at our Equator: 1670 km/hr = 1037 mi/hr

Note that our Earth has 24 Time Zones, so each zone is 1670 km or 1037 miles across at the Equator.

The Equator is 0° latitude. Going north, latitude increases to 90° North (N) latitude at the North Pole. Going south, latitude increases to 90°South (S) latitude at the South Pole.

Follow these steps to find your Latitude using your cell phone:

1. Type in your city's name and then type the word **latitude.**
   Latitude and Longitude are often given together. Latitude is given first and has an N for North or and S for South.
   The number may have decimal numbers. For example, type **Moscow latitude** to display 55.7558° N, 37.6173° E. In the Sample Table, the value 55.8 is approximated from 55.7558.

The numbers may have three parts: degrees, minutes and seconds. The first number in degrees is enough. Divide the minutes number by 60 to add a decimal value.
The number in degrees is represented by the Greek letter θ, theta. For Moscow, θ = 55.8°.

2. Now display your calculator on your cell phone.
3. Turn your cell phone sideways. The scientific math functions should appear. Ask some kid if needed.
4. Press the **cos** button. **cos(** is displayed.
5. Type theta, such as **55.8** for Moscow and press =. The cos value is displayed.
6. Press the **x** button to multiply
7. Type **1670** for speed in kilometers or **1037** for speed in miles.
8. Press the **=** button again and the orbital speed is displayed. If you entered1670 miles, you would get 583 miles/hour; if you entered 1670, you would get 939 kilometers/hour.

At latitude (θ) in degrees (°),

$$\boldsymbol{Rotation\ Speed} = \mathbf{cos}(\theta)\ \boldsymbol{X\ Earth\ Rotation\ Speed\ at\ Equator}$$

Examples:

At latitude 30° N or S: cos(30) * 1670 km/hr = .866 * 1670 km/hr = 1446 km/hr
At latitude 45° N or S: cos(45) * 1037 mi/hr = .707 * 1037 mi/hr = 733 mi/hr
At latitude 90° N or S: cos(90) * 1037 mi/hr = 0 * 1037 mi/hr = 0 (you spin)

Sample Table of Orbital Velocities

City	Latitude	mi/hr	km/h
Longyearbyen, Norway	78.1° N	214	344
Moscow, Russia	55.8° N	583	939
London, UK	51.5° N	646	1040
New York, USA	41.9° N	772	1243
Los Angeles, USA	34.1° N	859	1383
Quito, Ecuador	0.2° S	1037	1670
Rio de Janeiro, Brazil	22.9° S	955	1538
Cape Town, SA	33.9° S	861	1386
Ushuaia, Argentina	54.5° S	602	970

Longyearbyen, Norway is most northern city; Ushuaia, Argentina is most southern city. People may argue who is most, but either place is cold. If you print the table, the blank space is for you to enter your information.

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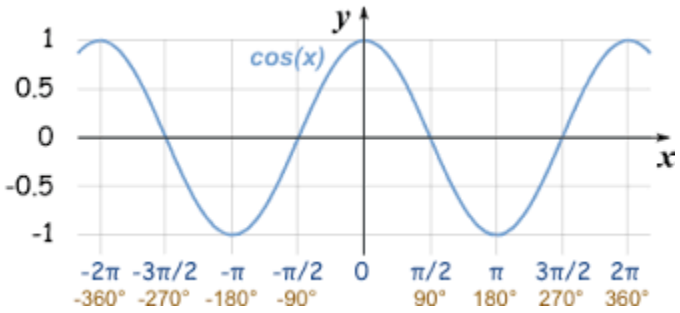
Here is some fun or painful math



Why cos? You don't care. Maybe a little curious?

Sin and cos are ways to show a wave or circular shape. Our Earth is a circular shape.

The equation makes the latitude (θ) correspond to the curve of our Earth by finding the cos(θ) and multiplying cos(θ) by the rotation speed at our Equator. At zero degrees on the graph, cos is one; at 90 degrees, cos is 0. Sin is the reverse. Cos values from 1 to 0 match our orbital speeds at different latitudes from the equator to the poles.

The latitudes are on a circular shape from the equator to the poles and cos graphs a circular shape. On the graph the Equator (0°) has cos(0°) = 1 and each pole (90°) has cos(90°) = 0. The cos values allow 0° to 90° to be scaled from 1670 km/hr (1037 mi/hr) to 0 along a curve.