DMS, Linear and Angular Speed

Section 4.1A

Precalculus PreAP/Dual, Revised ©2017

viet.dang@humbleisd.net

Degrees Minutes Seconds (DMS)

A. Written as: $D^\circ\ M'\ S''$
B. It can also be written in decimal degree form or degree form
C. Make sure it is in degree mode on the calculator
D. Boaters use DMS to help track other vestals
E. Pilots use DMS to track oncoming planes or assist to land

Steps in Writing in Decimal Form

A. Keep the first digits in degree form
B. Label the second number over 60 (how many minutes are there in an hour?) and convert the second number into a decimal form from a fraction form
C. Label the third number over 3600 (how many seconds are there in an hour?)
D. Add the digits together and label as degrees
E. If the given is negative, exclude the negative until the end

Example 1

Convert $36^\circ\ 14'\ 29''$ to decimal form. Round to 4 decimal places.

Step 1: Keep the first digits in degree form

$$36^\circ + 14' + 29''$$

EXAMPLE 1

Convert $36° \; 14' \; 29''$ to decimal form. Round to 4 decimal places.

Step 2: Label the second number over 60 (how many minutes are there in a hour?) and convert into a decimal

$$14' = \frac{14}{60} = 0.233$$

EXAMPLE 1

Convert $36° \; 14' \; 29''$ to decimal form. Round to 4 decimal places.

Step 3: Label the third number over 3600 (how many seconds are there in a hour?) using the calculator and convert it to a decimal

$$29' = \frac{29}{3600} = .0080$$

EXAMPLE 1

Convert $36^\circ\ 14'\ 29''$ to decimal form. Round to 4 decimal places.

Step 4: Add the figures together

$$36^\circ + 0.233 + 0.0080 =$$

$$\boxed{36.2410}$$

EXAMPLE 2

Convert $-5^\circ\ 57'\ 36''$ to decimal form. Round to 4 decimal places.

-5.96

Your Turn

Convert $35^\circ\ 15'\ 27''$ to decimal form. Round to 4 decimal places.

35.2575

Steps in Writing in Degree Form

A. Keep the first digits in degree form
B. Multiply the last numbers with the decimal (behind the degrees) by 60
C. Take the decimals from the previous answer in step 2 and multiply by 60 again
D. Put them together and label accordingly

Example 3

Convert $48.3625°$ to DMS form.

Step 1: Keep the first digits in degree form

Step 2: Multiply the last numbers with the decimal (behind the degrees) by .6 (60 degrees/1 minute)

$$48° \qquad 0.3625 \cdot 60$$

$$21.75$$

Example 3

Convert $48.3625°$ to DMS form.

Step 3: Take the decimals from the previous answer in step 2 and multiply by 60 again (60 seconds/1 minute)

$$21.75$$

$$.75 \cdot 60 = 45''$$

$$48°21'45''$$

Example 4

Convert $13.12345°$ to DMS form.

$13°7'24.42"$

Your Turn

Convert $43.5525°$ to DMS form.

$43°33'9"$

Angular Speed

A. Angular Speed applies to any object or particle that turns; angle through with the point *rotates* over time (also known as angle rotation)

B. Angular Speed Equation: $\frac{Angle}{Time} = \omega = \frac{\theta}{t}$

C. The angular speed of an object traveling in a circular path is the same, regardless of its distance from the center of the circle. When the angular speed of the object stays the same, the linear speed increases as the object moves farther from the center

D. Leave answers in radian mode

Angular Speed (Rotation)

Distance = Rate • Time

$$Rate = \frac{\text{Distance}}{\text{Time}}$$

$$\text{Angular Speed} = \frac{\text{Central Angle}}{\text{Time}}$$

$$\omega = \frac{\theta}{t}$$

EXAMPLE 5

The blades of the wind turbine are 116 feet long. The propeller rotates at 15 revolutions per minute. Find the angular speed.

$$\omega = \frac{\theta}{t}$$

$$\theta = (revolutions)(2\pi)$$

$$\theta = (15)(2\pi)$$

EXAMPLE 5

The blades of the wind turbine are 116 feet long. The propeller rotates at 15 revolutions per minute. Find the angular speed.

$$\theta = (15)(2\pi)$$

$$\theta = 30\pi \frac{\text{radians}}{\text{minute}}$$

$$\frac{\theta}{t} = \frac{30\pi \text{ radians}}{1 \text{ minute}}$$

$$\omega = 30\pi \frac{\text{radians}}{\text{minute}}$$

EXAMPLE 6

A Ferris wheel at a carnival has a diameter of 52 feet. Suppose it turns at a rate of 2 revolutions per minute. Determine the angular speed.

$$\omega = \frac{\theta}{t}$$

$$\omega = \frac{2(2\pi)\ ft}{1\text{min}}$$

$$\omega = 4\pi \frac{rad}{\text{min}}$$

YOUR TURN

The circular blade on a saw rotates at 4,200 revolutions per minute. Determine the angular speed of radians per second.

$$\omega = 140\pi \frac{rad}{\text{sec}}$$

LINEAR SPEED

A. Linear speed applies to any object or particle that moves; distance that the point *travels* over time (distance)
B. Linear Speed Equation: $\frac{Arc\ Length}{Time} = V = r\omega$ where $\omega = \frac{\theta}{t}$ is the angular speed
C. Therefore, Linear Speed is also known as (Radius) * (Angular Speed)
D. Leave answers in radian mode

Linear Speed (Distance)

Distance = Rate • Time

$$Rate = \frac{\text{Distance}}{\text{Time}}$$

$$\text{Linear Speed} = \frac{\text{Arc Length}}{\text{Time}}$$

$$V = \frac{r\theta}{t}$$

$$\boxed{V = r\omega}$$

EXAMPLE 7

The blades of the wind turbine are 116 feet long. The propeller rotates at 15 revolutions per minute. Find the linear speed.

$$V = r\left(\frac{\theta}{t}\right)$$

$$\omega = \frac{(15)(2\pi)rad}{1\min}$$

$$\omega = \frac{30\pi\ rad}{1\min}$$

EXAMPLE 7

The blades of the wind turbine are 116 feet long. The propeller rotates at 15 revolutions per minute. Find the linear speed.

$$\omega = \frac{30\pi \ rad}{1\text{min}}$$

$$V = (116\,ft.)\left(\frac{30\pi}{1\text{min}}\right)$$

$$V \approx 3480\pi \ \frac{ft}{\text{min}}$$

EXAMPLE 8

A merry go round makes 8 revolutions per minute. The horse is traveling with a radius of 12. How fast is the horse going in miles per hour?

$r = 12$

$\omega = 16\pi \ ft / \min$

$$V = r\omega$$

$$V = (12)\left(\frac{16\pi \ ft}{1\min}\right)\left(\frac{60\min}{1hour}\right)\left(\frac{1 \ mile}{5280 \ ft.}\right)$$

$$V = \frac{24\pi}{11} \ mph; \ 6.8544mph$$

YOUR TURN

The circular blade on a saw rotates at 4,200 revolutions per minute. Find the linear speed where the blade is 6 inches.

$$V = 50400\pi \ \frac{\text{inches}}{\text{min}}$$

ASSIGNMENT

Page 270

47-50 all, 59, 62-67 all (omit 66)