Finding the rate or time in a word problem on continuous exponential growth or decay

Suppose that the number of bacteria in a certain population increases according to a *continuous exponential growth model*. A sample of 2700 bacteria selected from this population reached the size of 2906 bacteria in three hours. Find the hourly growth rate parameter.

Note: This is a *continuous* exponential growth model.

Write your answer as a percentage. Do not round any intermediate computations, and round your percentage to the nearest hundredth.

use calculator

math 0:solver

0=P-Qe^(RT)

P=2906

Q=2700

R=? ← alpha enter

T = 3

R= .0245...

= 2.45%

We are asked to find the growth rate para

$$2906 = 2700e^{r(3)}$$

P=Qe^(RT)

To solve for r, we first divide both sides by

$$\frac{2906}{2700} = e^{3r}$$

algebra

We can then apply the natural logarithm t

P5: log of both sides

P1

$$\ln\left(\frac{2906}{2700}\right) = \ln\left(e^{3r}\right)$$

$$\ln\left(\frac{2906}{2700}\right) = 3r$$

inverse property f o f^{-1}

$$r = \frac{\ln\left(\frac{2906}{2700}\right)}{3}$$

algebra...

$$r = 0.02450\ldots$$

$$r \approx 2.45\ \%$$

Here is the answer.

$\boxed{2.45\ \%}$

Solving an equation involving logarithms on both sides: Problem type 2

Solve for x.

$$\ln(5x-3) = \ln 2$$

P5: log of both

intersection method

y1=ln(5x-3)

y2=ln(2)

calc:5 intersect

5x - 3 = 2

5x = 5

x = 1

Solving exponential equations by using logarithms and natural logarithms: Decin answers

Solve for the variable in the equations below.
Round your answers to the nearest hundredth.
Do not round any intermediate computations.

use calculator

$$e^{0.43y} = 8$$

$$3^{x-2} = 2$$

~~$3^x = 2$~~

P=8

Q=1

R=.43

T=alpha enter 4.84

y1=3^(x-2)

y2=2

calc 5: intersect <enter>x3 x = 2.63

P1: solve for exponent

$e^{0.43y} = 8$ $.43y = \ln(8)$ $y = \ln(8)/.43$

$=4.84$

$3^{x-2} = 2$ $x-2 = \log_3(2)$ P4: change

$x = \log(3)/\log(2)+2$

Expanding a logarithmic expression: Problem type 2 algebra

Use the properties of logarithms to expand $\log\left(\frac{z^4}{y^3 x}\right)$. $\log(z^4y^{-3}x^{-1})$

Each logarithm should involve only one variable and should not have any radicals or exponents.

You may assume that all variables are positive.

P2: sum product

$\cancel{\log(}z^4)$ $+ \log(y^{-3})$ $+ \log(x^{-1})$

P3: ladder

$4\log(z)$ $-3\log(y)$ $-\log(x)$

Arc length and central angle measure

A circle has a radius of $19\ \text{m}$. Find the length s of the arc intercepted by a central angle of $25°$.

radians $25^\circ \cdot \frac{\pi}{180^\circ} = \frac{25\pi}{180} = \theta$

Do not round any intermediate computations, and round your answer to the nearest tenth.

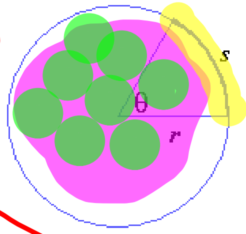
Suppose that a central angle of θ radians intercepts an arc of length s in a circle of radius r.

Then the length s of the arc is given by the following.

$s = r\cdot\theta$ Deriving this formula

unit Radius

$S = \boxed{\frac{25\pi}{180}}\boxed{19}$ 8.3



In order to use this equation, we must first convert the given angle to radian measure.

$$\theta = 25° = 25\cdot\left(\frac{\pi}{180}\right)\text{ radians} = \frac{5\pi}{36}\text{ radians}$$

length of a

"pizza bone"

Convert degrees to radians.

180 degrees = π radians

$$45^\circ\left(\frac{\pi}{180^\circ}\right) = \frac{\pi}{4}$$

radians

$$\frac{2\,\text{apple}}{\text{apple}} = 2$$

$$\frac{m^2}{m} = 1m$$

Coterminal angles

Answer the following.

(a) Find an angle between 0 and 2π that is coterminal with $-\frac{13\pi}{2}$.

(b) Find an angle between $0°$ and $360°$ that is coterminal with $676°$.

Give exact values for your answers.

$$-\frac{13\pi}{2}\cdot\left(\frac{180°}{\pi}\right) = -1170°$$

$$\begin{array}{r} -1170 \\ +360 \\ \hline -810 \\ +360 \\ \hline -450 \\ +360 \\ \hline -90 \\ +360 \\ \hline 270° \end{array}$$

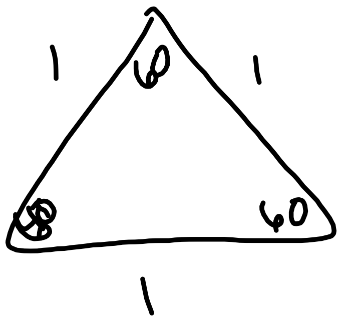
Convert to Radians $\times \frac{\pi}{180}$

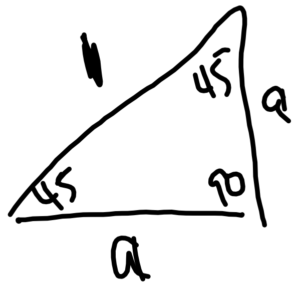
$$270° \cdot \frac{\pi}{180°} = \frac{3\pi}{2}$$

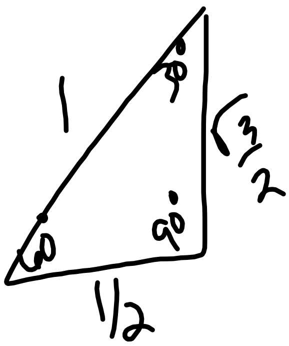
676degrees

-360

316 degree







$$\left(\frac{1}{2}\right)^2 + a^2 = 1$$

$$a^2 = \frac{3}{4}$$

$$a = \frac{\sqrt{3}}{2}$$

$$a^2 + a^2 = 1$$

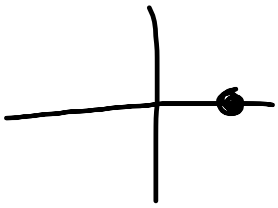
$$2a^2 = 1$$

$$a^2 = \frac{1}{2}$$

$$a = \sqrt{\frac{1}{2}} = \frac{\sqrt{2}}{2} = \frac{1}{\sqrt{2}}$$

∴ 2070...

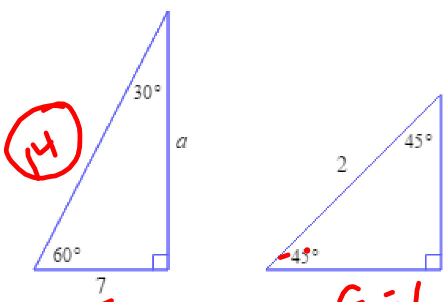
	0°	30°	45°	60°	90°
$\cos(\theta)$	$\frac{\sqrt{4}}{2}$ 1	$\frac{\sqrt{3}}{2}$ .866	$\frac{\sqrt{2}}{2}$ .7070	$\frac{\sqrt{1}}{2}$ .5	$\frac{\sqrt{0}}{2}$ 0
$\sin(\theta)$	$\frac{\sqrt{0}}{2}$	$\frac{\sqrt{1}}{2}$	$\frac{\sqrt{2}}{2}$	$\frac{\sqrt{3}}{2}$	$\frac{\sqrt{4}}{2}$



Special right triangles: Exact answers

For the right triangles below, find the exact values of the side lengths a and c.

If necessary, write your responses in simplified radical form.



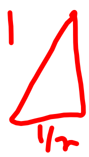
$c = 1$

$c = 1$

$2c^2 = 2$

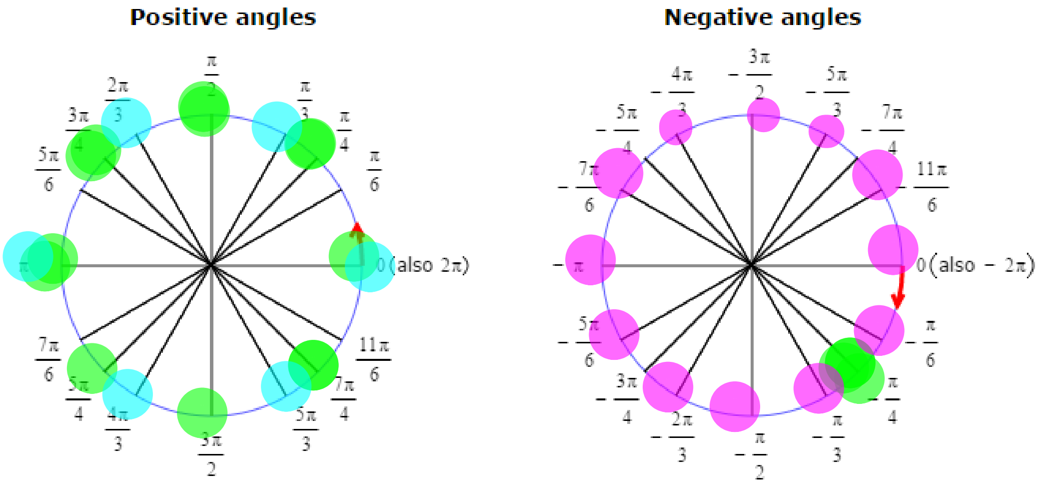
$c^2 = 1$

$c = 1$



$a^2 + 7^2 = 14^2$

$a^2 =$



Finding trigonometric ratios from a point on the unit circle

Suppose that θ is an angle in standard position whose terminal side intersects the unit circle at $\left(-\frac{\sqrt{2}}{2}, -\frac{\sqrt{2}}{2}\right)$.

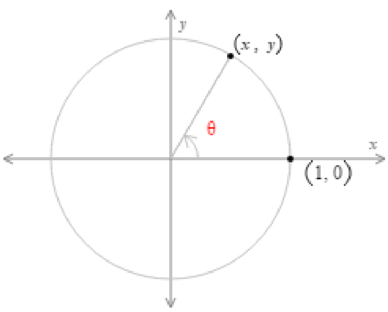
Find the exact values of $\sin\theta$, $\sec\theta$, and $\cot\theta$.

Suppose that θ is an angle in standard position.
Let (x, y) be the terminal point of θ (where the terminal side of θ intersects the unit circle).
Then the six trigonometric functions are defined as follows.

$\sin\theta = y = -\frac{\sqrt{2}}{2}$ $\csc\theta = \frac{1}{y},\ y \neq 0$

$\cos\theta = x$ $\sec\theta = \frac{1}{x} = -\frac{2}{\sqrt{2}},\ x \neq 0$

$\tan\theta = \frac{y}{x},\ x \neq 0$ $\cot\theta = \frac{x}{y} = 1,\ y \neq 0$



Trigonometric functions and special angles: Problem type 2

Find the exact values below. If applicable, click on "Undefined".

$\sec 315°$

$\tan 315°$

We have the following fundamental identities.

$$\csc\theta = \frac{1}{\sin\theta} \qquad \sec\theta = \frac{1}{\cos\theta}$$

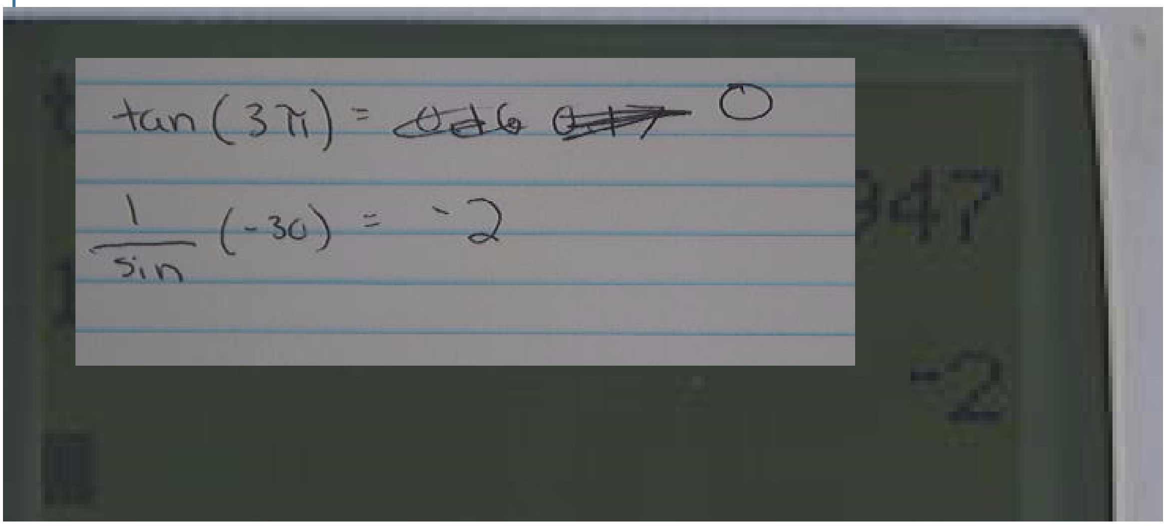
$$\tan\theta = \frac{\sin\theta}{\cos\theta} \qquad \cot\theta = \frac{1}{\tan\theta} = \frac{\cos\theta}{\sin\theta}$$

Trigonometric functions and special angles: Problem type 3

Find the exact values below. If applicable, click on "Undefined."

$\tan 3\pi$

$\csc(-30°)$



Area of a sector of a circle

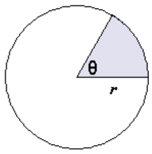
A circle has a radius of 6cm. A sector of the circle has a central angle of $\frac{\pi}{3}$ radians. Find the area of the sector.

Do not round any intermediate computations. Round your answer to the nearest tenth.

The area A of a sector of a circle with radius r and central angle θ is as follows.

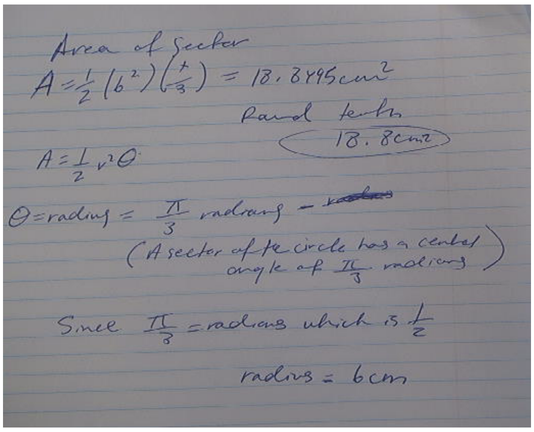
$$A = \frac{1}{2}r^2\theta$$

Deriving the formula



Note that for this formula, θ *must* be in radians.

For our problem, the radius is $r = 6\text{cm}$ and the central angle is $\theta = \frac{\pi}{3}$ radians.


Area of Sector

$A = \frac{1}{2}(6^2)(\frac{\pi}{3}) = 18.8495\text{cm}^2$

Round tenth

18.8cm^2

$A = \frac{1}{2}r^2\theta$

θ = radians = $\frac{\pi}{3}$ radians – ~~radians~~

(A sector of the circle has a central angle of $\frac{\pi}{3}$ radians)

Since $\frac{\pi}{3}$ = radians which is $\frac{1}{2}$

radius = 6cm

Angular and linear speed

A ceiling fan has 19-inch blades (so the radius of the circular fan is 19 inches). Suppose the linear speed of the tip of a blade is 9 feet per second.

(a) Find the angular speed of the fan in radians per minute.

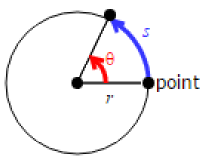
(b) Find the number of revolutions a blade makes per minute.

Do not round any intermediate computations, and round your answer to the nearest whole number.

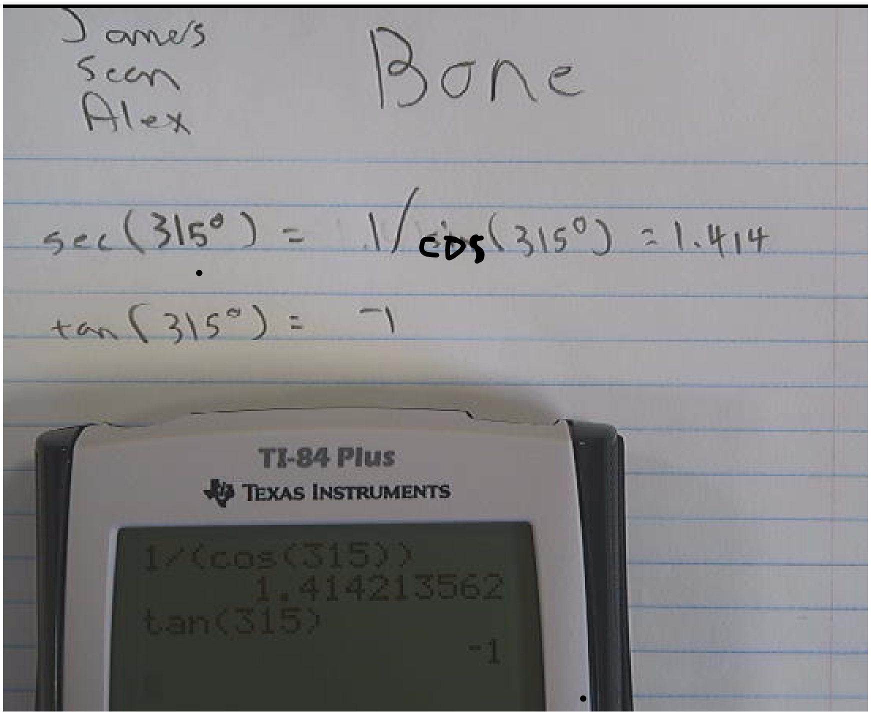
here are two common measures for the speed of a point moving in a circular arc: *linear speed* nd *angular speed*.

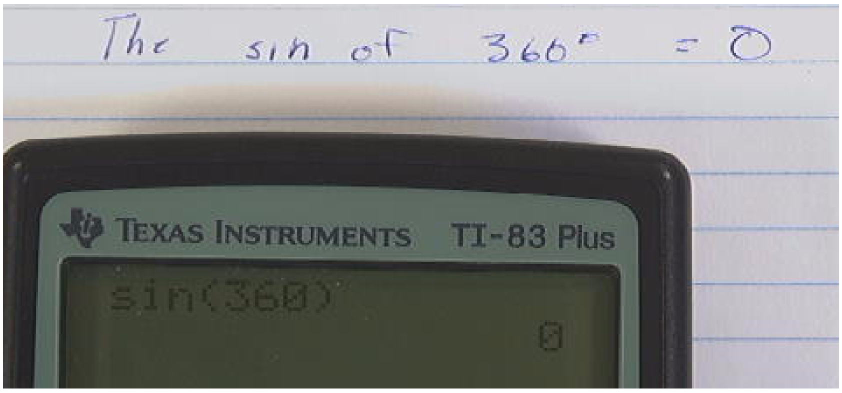
inear speed tells us the distance traveled in a given amount of time.
or a point moving in a circle, the distance traveled is given by the **arc length s**.
o we can compute the linear speed v as follows.

$$v = \frac{\text{arc length}}{\text{time}} = \frac{s}{t}$$



ngular speed tells us how much of an angle is swept out in a given mount of time. For a point moving in a circle, the angle swept out is iven by the **central angle θ**. So we can compute the angular speed ω s follows.


James
Sean
Alex
Bone
sec(315°) = 1/cos(315°) = 1.414
tan(315°) = -1
TI-84 Plus
TEXAS INSTRUMENTS
1/(cos(315))
1.414213562
tan(315)
-1


The sin of 360° = 0
TEXAS INSTRUMENTS
TI-83 Plus
sin(360)
0