

WALT Understand the calculator keys to apply trig rules

Success Criteria I know three basic rules of trig ratios(trig application) I can use the degrees and minutes button

For greater accuracy, we can measure angles not only in **degrees** ($^{\circ}$) but also in parts of degrees, as decimals or using the units **minutes** ($'$) and **seconds** ($''$).

1 degree = 60 minutes

1 minute = 60 seconds

We will be measuring angles accurate to the nearest minute. Angle 53 degrees 18 minutes is written $53^{\circ}18'$.

EXAMPLE 1

Find the following correct to 4 decimal places.

a $\cos 84.3^{\circ}$

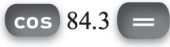


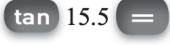
b $\sin 68.7^{\circ}$

c $\tan 15.5^{\circ}$



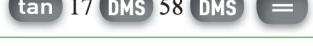
d $\cos 78^{\circ}15'$

e $\sin 11^{\circ}12'$

f $\tan 17^{\circ}58'$

	Solve	Think	Apply
a	$\cos 84.3^{\circ} \approx 0.0993$		Make sure your calculator is in degree mode. Some calculators have a  key instead of a DMS key.
b	$\sin 68.7^{\circ} \approx 0.9317$		
c	$\tan 15.5^{\circ} \approx 0.2773$		

EXAMPLE 1 CONTINUED

	Solve	Think	Apply
d	$\cos 78^{\circ}15' \approx 0.2036$		On some calculators the second DMS is not required.
e	$\sin 11^{\circ}12' \approx 0.1942$		
f	$\tan 17^{\circ}58' \approx 0.3243$		

1 Find the following correct to 4 decimal places.

a $\sin 36.8^{\circ}$

b $\cos 14.23^{\circ}$

c $\tan 8.11^{\circ}$

d $\cos 65.25^{\circ}$

e $\cos 89^{\circ}21'$

f $\tan 18^{\circ}23'$

g $\tan 68^{\circ}23'$

h $\sin 45^{\circ}21'$

i $\cos 57^{\circ}51'$

j $\cos 33^{\circ}21'$

k $\tan 21^{\circ}33'$

l $\sin 11^{\circ}11'$




EXAMPLE 2

Evaluate the following correct to 4 decimal places.

a $12 \cos 15.6^{\circ}$

b $5 \sin 11^{\circ}15'$

c $\frac{3 \tan 11^{\circ}51'}{\cos 23^{\circ}15'}$

	Solve	Think	Apply
a	$12 \cos 15.6^{\circ} \approx 11.5580$		Remember that the fraction line is a grouping symbol. Insert brackets if you are not sure of the order of operations.
b	$5 \sin 11^{\circ}15' \approx 0.9755$		
c	$\frac{3 \tan 11^{\circ}51'}{\cos 23^{\circ}15'} \approx 0.6851$		

2 Evaluate the following correct to 4 decimal places.

a $8 \cos 23.1^\circ$

b $5 \tan 16.4^\circ$

c $15 \sin 48.18^\circ$

d $23 \sin 75^\circ 12'$

e $8.3 \tan 58^\circ 51'$

f $12.3 \cos 27^\circ 48'$

g $\frac{9 \sin 11^\circ 51'}{\sin 31^\circ}$

h $\frac{8 \tan 16^\circ 16'}{\sin 15^\circ}$

i $\frac{12.3 \cos 48^\circ}{\sin 16^\circ 15'}$

j $\frac{8.7 \tan 75^\circ 14'}{13.2}$

k $\frac{4.2 \cos 18.3^\circ}{6.8}$

l $\frac{3 \sin 83^\circ 12'}{16.5}$

m $\frac{4 \sin 18^\circ \cos 18^\circ}{3}$

n $\frac{11 \tan 16^\circ \cos 14^\circ}{\sin 12^\circ}$

o $\frac{8.3 \cos 11^\circ 15'}{\sin 11^\circ 15'}$

Using trigonometric ratios to find angles

You can work backwards on a calculator to find an angle from one of the trigonometric ratios, by using one of the key combinations **SHIFT** **tan** or **SHIFT** **sin** or **SHIFT** **cos**. These may appear on your calculator display as \tan^{-1} or \sin^{-1} or \cos^{-1} .

For example, if $\sin \theta = 0.4369$

then $\theta = \sin^{-1} 0.4369$

where $\sin^{-1} 0.4369$ means 'the angle whose sine is 0.4369'.

Similarly, \cos^{-1} means 'the angle whose cosine is' and \tan^{-1} means 'the angle whose tangent is'.

EXAMPLE 3

Find θ to the nearest:

i degree

ii minute.

a $\sin \theta = 0.6314$

b $\tan \theta = 3.6$

c $\cos \theta = 0.8$

	Solve	Think	Apply
a	i $\sin \theta = 0.6314$ $\theta = 39.153\dots$ $\approx 39^\circ$	SHIFT sin 0.6314 =	Make sure your calculator is in degree mode. Ensure that SHIFT is pressed before the trigonometric ratios so that the answer is an angle. The half-way point for rounding is 30 seconds. Below 30 seconds round down; 30 seconds or more, round up. Note that some calculators require SHIFT before DMS to convert to minutes and seconds.
	ii $\theta = 39^\circ 9' 12.55\dots''$ $\approx 39^\circ 9'$ to the nearest minute as $12.55\dots < 30$	DMS As the seconds are less than 30, round the minutes down.	
b	i $\tan \theta = 3.6$ $\theta = 74.475\dots$ $\approx 74^\circ$	SHIFT tan 3.6 =	
	ii $\theta = 74^\circ 28' 33.20\dots''$ $\approx 74^\circ 29'$ to the nearest minute as $33.2 > 30$	DMS As the seconds are greater than or equal to 30, round the minutes up.	
c	i $\cos \theta = 0.8$ $\theta = 36.869\dots$ $\approx 37^\circ$	SHIFT cos 0.8 =	
	ii $\theta = 36^\circ 52' 11.63\dots''$ $\approx 36^\circ 52'$ to the nearest minute as $11.63 < 30$	DMS	

3 Write these calculator displays as angles to the nearest minute.

a $43^{\circ}27'14.2''$

b $62^{\circ}15'58.13''$

c $14^{\circ}3'0''$

d $81^{\circ}53'30''$

e $21^{\circ}59'48.72''$

f $10^{\circ}1'28.42''$

g $35^{\circ}28'18.3''$

h $72^{\circ}51'38.5''$

i $27^{\circ}53'58.1''$

j $39^{\circ}35'11.3''$

k $68^{\circ}54'41.2''$

l $0^{\circ}3'34.2''$

4 Find the value of θ to the nearest:

i degree

ii minute.

a $\sin \theta = 0.3625$

b $\cos \theta = 0.1445$

c $\tan \theta = 2.1351$

d $\cos \theta = 0.6731$

e $\tan \theta = 4.1371$

f $\sin \theta = 0.1113$

g $\tan \theta = 0.0371$

h $\sin \theta = 0.5512$

i $\cos \theta = 0.0314$

j $\sin \theta = 0.0027$

k $\tan \theta = 23.7215$

l $\cos \theta = 0.9811$

m $\cos \theta = 0.6614$

n $\sin \theta = 0.6262$

o $\tan \theta = 0.2222$

EXAMPLE 4

Find θ to the nearest:

i degree

ii minute.

a $\sin \theta = \frac{5}{9}$

b $\cos \theta = \frac{6}{13}$

c $\tan \theta = \frac{18}{7}$

	Solve	Think	Apply
a	i $\sin \theta = \frac{5}{9}$ $\theta = 33.74\dots$ $\approx 34^{\circ}$		<p>Make sure that the calculator is in degree mode.</p> <p>Press first to obtain an angle.</p> <p>Put the fraction in brackets before pressing .</p> <p>Round accordingly.</p> <p>Note that some calculators require to convert to minutes and seconds.</p>
	ii $\theta = 33^{\circ}44'56.35\dots''$ $\approx 33^{\circ}45'$	 As the seconds are greater than 30, round the minutes up.	
b	i $\cos \theta = \frac{6}{13}$ $\theta = 62.51\dots$ $\approx 63^{\circ}$		
	ii $\theta = 62^{\circ}30'48.86\dots''$ $\approx 62^{\circ}31'$	 As the seconds are greater than 30, round the minutes up.	
c	i $\tan \theta = \frac{18}{7}$ $\theta = 68.74\dots$ $\approx 69^{\circ}$		
	ii $\theta = 68^{\circ}44'58.18\dots''$ $\approx 68^{\circ}45'$	 As the seconds are greater than 30, round the minutes up.	

5 Find the value of θ to the nearest:

i degree

a $\tan \theta = \frac{14}{3}$

b $\cos \theta = \frac{3}{11}$

ii minute.

c $\sin \theta = \frac{11}{18}$

d $\sin \theta = \frac{4}{29}$

e $\tan \theta = \frac{6}{7}$

f $\cos \theta = \frac{14}{17}$

g $\sin \theta = \frac{0.013}{0.214}$

h $\cos \theta = \frac{6.2}{15}$

i $\tan \theta = \frac{11.27}{15}$

j $\cos \theta = \frac{1}{3}$

k $\sin \theta = \frac{3}{4}$

l $\tan \theta = \frac{4}{3}$

6 Find angle A to the nearest minute given that:

a $\cos A = 0.7$

b $\sin A = 0.642$

c $\tan A = 3.265$

EXERCISE 6C

1 a 0.5990

b 0.9693

c 0.1425

d 0.4187

e 0.0113

f 0.3323

g 2.5236

h 0.7114

i 0.5321

j 0.8353

k 0.3949

l 0.1939

2 a 7.3586

b 1.4716

c 11.1786

d 22.2369

e 13.7320

f 10.8803

g 3.5884

h 9.0191

i 29.4119

j 2.5004

k 0.5864

l 0.1805

m 0.3919

n 14.7202

o 41.7269

3 a $43^\circ 27'$

b $62^\circ 16'$

c $14^\circ 3'$

d $81^\circ 54'$

e $22^\circ 0'$

f $10^\circ 1'$

g $35^\circ 28'$

h $72^\circ 52'$

i $27^\circ 54'$

j $39^\circ 35'$

k $68^\circ 55'$

l $0^\circ 4'$

4 a i 21°

ii $21^\circ 15'$

b i 82°

ii $81^\circ 42'$

c i 65°

ii $64^\circ 54'$

d i 48°

ii $47^\circ 42'$

e i 76°

ii $76^\circ 25'$

f i 6°

ii $6^\circ 23'$

g i 2°

ii $2^\circ 7'$

h i 33°

ii $33^\circ 27'$

i i 88°

ii $88^\circ 12'$

j i 0°

ii $0^\circ 9'$

k i 88°

ii $87^\circ 35'$

l i 11°

ii $11^\circ 9'$

m i 49°

ii $48^\circ 36'$

n i 39°

ii $38^\circ 46'$

o i 13°

ii $12^\circ 32'$

5 a i 78°

ii $77^\circ 54'$

b i 74°

ii $74^\circ 10'$

c i 38°

ii $37^\circ 40'$

d i 8°

ii $7^\circ 56'$

e i 41°

ii $40^\circ 36'$

f i 35°

ii $34^\circ 34'$

g i 3°

ii $3^\circ 29'$

h i 66°

ii $65^\circ 35'$

i i 37°

ii $36^\circ 55'$

j i 71°

ii $70^\circ 32'$

k i 49°

ii $48^\circ 35'$

l i 53°

ii $53^\circ 8'$

6 a $45^\circ 34'$

b $39^\circ 56'$

c $72^\circ 58'$