

## 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** ( $''$ ).

$$1 \text{ degree} = 60 \text{ minutes}$$

$$1 \text{ minute} = 60 \text{ seconds}$$

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**  $\cos 84.3^{\circ}$

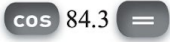


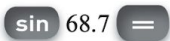
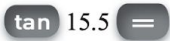
**b**  $\sin 68.7^{\circ}$

**c**  $\tan 15.5^{\circ}$





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

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

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

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

### EXAMPLE 1 CONTINUED

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

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



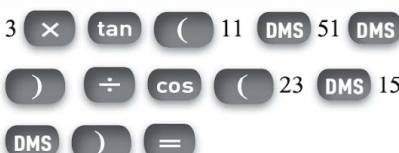
### EXAMPLE 2

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

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  $\theta$  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 $\sin \theta = 0.6314$ $\theta = 39.153\dots$ $\approx 39^\circ$	<b>SHIFT</b> <b>sin</b> 0.6314 <b>=</b>	Make sure your calculator is in degree mode. Ensure that <b>SHIFT</b> 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 <b>SHIFT</b> before <b>DMS</b> to convert to minutes and seconds.
	ii $\theta = 39^\circ 9' 12.55\dots''$ $\approx 39^\circ 9'$ to the nearest minute as $12.55\dots < 30$	<b>DMS</b> As the seconds are less than 30, round the minutes down.	
b	i $\tan \theta = 3.6$ $\theta = 74.475\dots$ $\approx 74^\circ$	<b>SHIFT</b> <b>tan</b> 3.6 <b>=</b>	
	ii $\theta = 74^\circ 28' 33.20\dots''$ $\approx 74^\circ 29'$ to the nearest minute as $33.2 > 30$	<b>DMS</b> As the seconds are greater than or equal to 30, round the minutes up.	
c	i $\cos \theta = 0.8$ $\theta = 36.869\dots$ $\approx 37^\circ$	<b>SHIFT</b> <b>cos</b> 0.8 <b>=</b>	
	ii $\theta = 36^\circ 52' 11.63\dots''$ $\approx 36^\circ 52'$ to the nearest minute as $11.63 < 30$	<b>DMS</b>	

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  $\theta$  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  $\theta$  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 $\sin \theta = \frac{5}{9}$ $\theta = 33.74\dots$ $\approx 34^{\circ}$		Make sure that the calculator is in degree mode. Press <b>SHIFT</b> first to obtain an angle. Put the fraction in brackets before pressing <b>=</b> . Round accordingly. Note that some calculators require <b>SHIFT</b> <b>DMS</b> to convert to minutes and seconds.
	ii $\theta = 33^{\circ}44'56.35\dots''$ $\approx 33^{\circ}45'$	<b>DMS</b> 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 $\theta = 62^{\circ}30'48.86\dots''$ $\approx 62^{\circ}31'$	<b>DMS</b> 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 $\theta = 68^{\circ}44'58.18\dots''$ $\approx 68^{\circ}45'$	<b>DMS</b> As the seconds are greater than 30, round the minutes up.	

5 Find the value of  $\theta$  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  $21^\circ$

ii  $21^\circ 15'$

b i  $82^\circ$

ii  $81^\circ 42'$

c i  $65^\circ$

ii  $64^\circ 54'$

d i  $48^\circ$

ii  $47^\circ 42'$

e i  $76^\circ$

ii  $76^\circ 25'$

f i  $6^\circ$

ii  $6^\circ 23'$

g i  $2^\circ$

ii  $2^\circ 7'$

h i  $33^\circ$

ii  $33^\circ 27'$

i i  $88^\circ$

ii  $88^\circ 12'$

j i  $0^\circ$

ii  $0^\circ 9'$

k i  $88^\circ$

ii  $87^\circ 35'$

l i  $11^\circ$

ii  $11^\circ 9'$

m i  $49^\circ$

ii  $48^\circ 36'$

n i  $39^\circ$

ii  $38^\circ 46'$

o i  $13^\circ$

ii  $12^\circ 32'$

5 a i  $78^\circ$

ii  $77^\circ 54'$

b i  $74^\circ$

ii  $74^\circ 10'$

c i  $38^\circ$

ii  $37^\circ 40'$

d i  $8^\circ$

ii  $7^\circ 56'$

e i  $41^\circ$

ii  $40^\circ 36'$

f i  $35^\circ$

ii  $34^\circ 34'$

g i  $3^\circ$

ii  $3^\circ 29'$

h i  $66^\circ$

ii  $65^\circ 35'$

i i  $37^\circ$

ii  $36^\circ 55'$

j i  $71^\circ$

ii  $70^\circ 32'$

k i  $49^\circ$

ii  $48^\circ 35'$

l i  $53^\circ$

ii  $53^\circ 8'$

6 a  $45^\circ 34'$

b  $39^\circ 56'$

c  $72^\circ 58'$