

Welcome Back MYP Math 9!

	Assignment Effort Grade (Circle One)	Comments (What was interesting or challenging?)
Monday Date: <u>11/13</u> Topic: <u>20E Problem Solving</u>	0 1 2	
Tuesday Date: <u>11/14</u> Topic: <u>Quiz 3.1 Review</u>	0 1 2	
Wednesday Date: <u>11/15</u> Topic: <u>Quiz 3.1 - No homework</u>	0 1 2	
Thursday Date: _____ Topic: _____	0 1 2	
Friday Date: _____ Topic: _____	0 1 2	

Class Plan:

1. Warm-up - Opening Problem
2. Investigate Trigonometry
3. Joke break!
3. Practice!

Chapter

13

Trigonometry

Contents:

- A** Labelling right angled triangles
- B** The trigonometric ratios
- C** Finding side lengths
- D** Finding angles
- E** Problem solving with trigonometry
- F** Bearings
- G** 3-dimensional problem solving



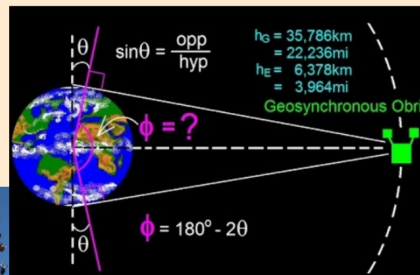
Relationship of sides & angles

Questions we will explore in Unit 3:

How can you measure without direct measuring tools?

How are angles measured?

Where is trigonometry applied?

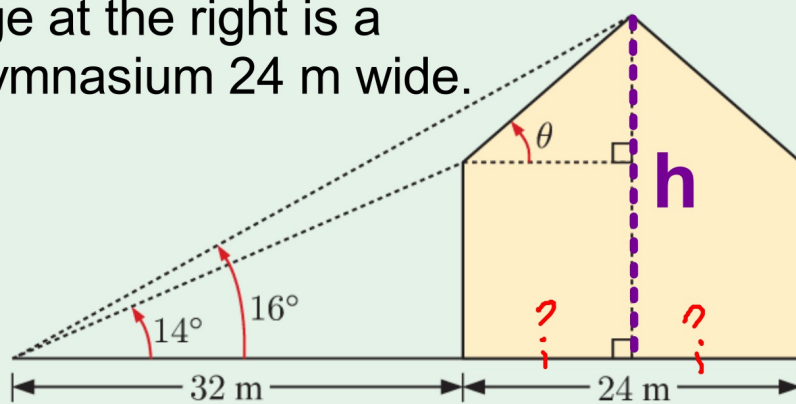


Warm-up - Opening Problem, Page 252

The image at the right is a school gymnasium 24 m wide.



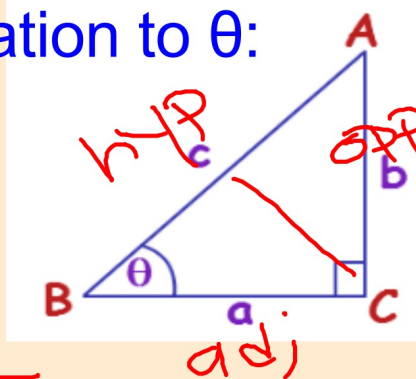
?



- 1) What questions can be answered from the diagram?
- 2) What additional information is needed to find the **height** of the gym?

Introduction: Draw and record in notebook

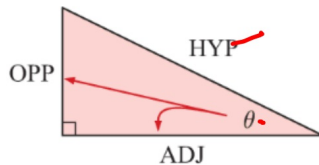
Name the sides in relation to θ :
(the angle)



- 1) Hypotenuse: c or \overline{AB}
- 2) Adjacent (next to): a or \overline{BC}
- 3) Opposite (across): b or \overline{AC}

A**LABELLING RIGHT ANGLED TRIANGLES****Draw diagram in your notebook**

In trigonometry, there is a convention for labelling the sides of a right angled triangle.



For the right angled triangle with angle θ :

- the **hypotenuse (HYP)** is the longest side
- the **opposite (OPP)** side is opposite θ
- the **adjacent (ADJ)** side is adjacent to θ .

The hypotenuse is opposite the right angle.

Remember:

A

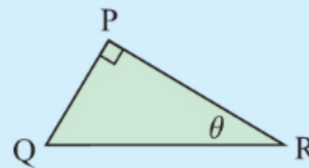
LABELLING RIGHT ANGLED TRIANGLES

Example 1

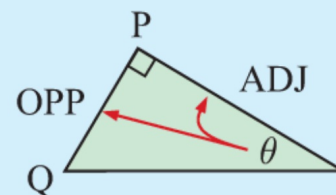
Self Tutor

For the triangle alongside, name the:

- a hypotenuse
- b side opposite θ
- c side adjacent to θ .



- a The hypotenuse is [QR].
- b The side opposite θ is [PQ].
- c The side adjacent to θ is [PR].



Practice!

Investigate!

1) **Do:** Parts 1 - 4 (Complete **table 1**)

(#3 challenge - put hypotenuse into simplest radical form)

Studied Trigonometry? **Also do: Table 2**

2) **Part 5:** Use resources to find defined ratios

Sin, cos, tan,....(sec, csc, cot)



3) **Label** the ratios in the table(s) with the **correct** trigonometric ratio.

Sine of theta: $\sin(\theta) = \text{---}$

Cosine of theta: $\cos(\theta) = \text{---}$

Tangent of theta: $\tan(\theta) = \text{---}$

4) **Practice, Apply trigonometric ratios!**

5) **Whole Group:** Share findings

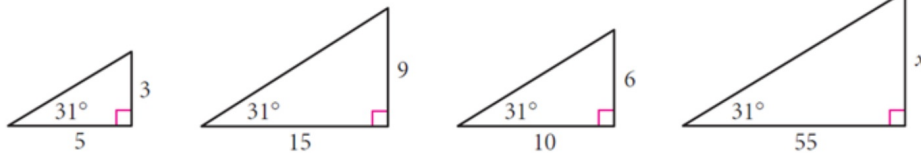
Investigate!

1) Do: Parts 1 - 4 (Complete table 1)

Studied Trigonometry? Also do: Table 2

MYP 9 Trigonometric Ratios Investigation

Name _____



1. The four triangles above are similar. Which corresponding pairs of angles show the similarity?
2. What is a fair approximation of x ? Explain your reasoning.
3. Solve for the hypotenuse lengths and label the triangles in the table below.
[Challenge: Write the hypotenuses in *exact radical form*. What patterns do you notice?

Investigate (Solutions)

1) Do: Parts 1 - 4 (Complete table 1)

Studied Trigonometry? Also do: Table 2

MYP 9 Trigonometric Ratios Investigation Name _____

1. The four triangles above are similar. Which corresponding pairs of angles show the similarity?

$\angle 31^\circ = \angle 31^\circ$ $90^\circ = 90^\circ$

2. What is a fair approximation of x ? Explain your reasoning.

$\frac{3}{5} = \frac{x}{55}$ $5x = 3(55)$ $5x = 165$ $x = 33$

3. Solve for the hypotenuse lengths and label the triangles in the table below.
 [Challenge: Write the hypotenuses in *exact radical form*. What patterns do you notice?]

$a = \sqrt{3^2 + 5^2}$	$c = \sqrt{6^2 + 10^2}$	$d = \sqrt{55^2 + 33^2}$
$a = \sqrt{34}$	$c = \sqrt{36 + 100}$	$d = \sqrt{3025 + 1089}$
$b = \sqrt{9^2 + 15^2}$	$c = \sqrt{136}$	$d = \sqrt{4114}$
$b = \sqrt{81 + 225}$	$c = \sqrt{4 \cdot 34}$	$d = \sqrt{121 \cdot 34}$
$b = \sqrt{306} = 3\sqrt{34}$	$c = 2\sqrt{34}$	$d = 11\sqrt{34}$

} All multiples of $\sqrt{34}$!

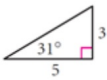
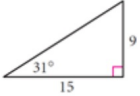

Investigate!

1) Do: Parts 1 - 4 (Complete table 1)

Studied Trigonometry? Also do: Table 2

If the three ratios above are familiar to you, then continue with table 2.

4. Solve for the ratios of the side lengths, in relation to the 31 degree angle. Round to the nearest 0.01

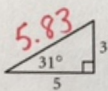
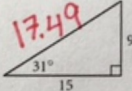
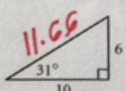
Table 1 Most common Trigonometric Ratios			
$\frac{\textit{opposite}}{\textit{hypotenuse}}$			
$\frac{\textit{adjacent}}{\textit{hypotenuse}}$			
$\frac{\textit{opposite}}{\textit{adjacent}}$			

Investigate (Solutions)

1) Do: Parts 1 - 4 (Complete table 1)

Studied Trigonometry? Also do: Table 2

4. Solve for the ratios of the side lengths, in relation to the 31 degree angle. Round to the nearest 0.01

Table 1 Most common Trigonometric Ratios			
$\sin \theta = \frac{\text{opposite}}{\text{hypotenuse}}$	$\frac{3}{5.83} \approx .515$	$\frac{9}{17.49} \approx .515$	$\frac{6}{11.66} \approx .515$
$\cos \theta = \frac{\text{adjacent}}{\text{hypotenuse}}$	$\frac{5}{5.83} \approx .86$	$\frac{15}{17.49} \approx .86$	$\frac{10}{11.66} \approx .86$
$\tan \theta = \frac{\text{opposite}}{\text{adjacent}}$	$\frac{3}{5} = .6$	$\frac{9}{15} = .6$	$\frac{6}{10} = .6$

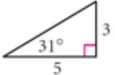
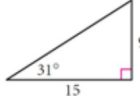

If the three ratios above are familiar to you, then continue with table 2.

Investigate!

1) Do: Parts 1 - 4 (Complete table 1)

Studied Trigonometry? Also do: Table 2

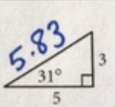
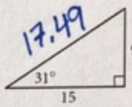
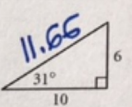
If the three ratios above are familiar to you, then continue with table 2.

Table 2 The remaining of the Six Trigonometric Ratios			
$\frac{\text{hypotenuse}}{\text{opposite}}$			
$\frac{\text{hypotenuse}}{\text{adjacent}}$			
$\frac{\text{adjacent}}{\text{opposite}}$			

Investigate (Solutions)

1) Do: Parts 1 - 4 (Complete table 1)

Studied Trigonometry? Also do: Table 2

Table 2 The remaining of the Six Trigonometric Ratios			
$\csc \theta = \frac{\text{hypotenuse}}{\text{opposite}}$	$\frac{5.83}{3} \approx 1.94$	$\frac{17.49}{9} \approx 1.94$	$\frac{11.66}{6} = 1.94$
$\sec \theta = \frac{\text{hypotenuse}}{\text{adjacent}}$	$\frac{5.83}{5} \approx 1.17$	$\frac{17.49}{15} \approx 1.17$	$\frac{11.66}{10} \approx 1.17$
$\cot \theta = \frac{\text{adjacent}}{\text{opposite}}$	$\frac{5}{3} \approx 1.67$	$\frac{15}{9} \approx 1.67$	$\frac{10}{6} \approx 1.67$

Investigate!


2) **Part 5:** Use resources to find defined ratios **Sin, cos, tan,....**
(sec, csc, cot)

3) **Label** the ratios in the table(s) with the **correct** trig. ratio.

Focus on the common three (sin, cos, tan)

***until you are confident to move forward with
the other three ratios.***

Sine of theta:	$\sin(\theta) = \frac{\text{opp}}{\text{hyp}}$	Secant of theta:	$\sec(\theta) = \text{---}$
Cosine of theta:	$\cos(\theta) = \frac{\text{adj}}{\text{hyp}}$	Cosecant of theta:	$\csc(\theta) = \text{---}$
Tangent of theta:	$\tan(\theta) = \frac{\text{opp.}}{\text{adj.}}$	Cotangent of theta:	$\cot(\theta) = \text{---}$



hypotenuse

adjacent side

opposite side

Investigate!

2) **Part 5:** Use resources to find defined ratios **Sin, cos, tan,....**
(**sec, csc, cot**)

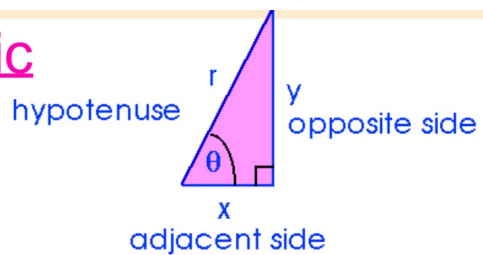
3) **Label** the ratios in the table(s) with the **correct** trig. ratio.

Focus on the common three (sin, cos, tan)

***until you are confident to move forward with
the other three ratios.***

Sine of theta:	$\sin(\theta) = \frac{\text{OPP}}{\text{HYP}}$	Secant of theta:	$\sec(\theta) = \frac{\text{HYP}}{\text{adj}}$
Cosine of theta:	$\cos(\theta) = \frac{\text{ADJ}}{\text{HYP}}$	Cosecant of theta:	$\csc(\theta) = \frac{\text{HYP}}{\text{opp}}$
Tangent of theta:	$\tan(\theta) = \frac{\text{OPP}}{\text{ADJ}}$	Cotangent of theta:	$\cot(\theta) = \frac{\text{ADJ}}{\text{OPP}}$

The 6 Trigonometric Ratios



Cosine: $\cos \theta = \frac{x}{r}$

Secant: $\sec \theta = \frac{r}{x} = \frac{1}{\cos \theta}$

Sine: $\sin \theta = \frac{y}{r}$

Cosecant: $\csc \theta = \frac{r}{y} = \frac{1}{\sin \theta}$

Tangent: $\tan \theta = \frac{y}{x} = \frac{\sin \theta}{\cos \theta}$

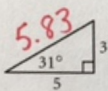
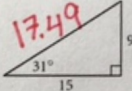
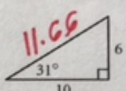
Cotangent: $\cot \theta = \frac{x}{y} = \frac{\cos \theta}{\sin \theta}$

Investigate! (Solutions)

2) **Part 5:** Use resources to find defined ratios **Sin, cos, tan,....**
(sec, csc, cot)

3) **Label** the ratios in the table(s) with the **correct** trig. ratio.

4. Solve for the ratios of the side lengths, in relation to the 31 degree angle. Round to the nearest 0.01

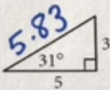
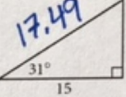
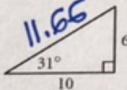
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Cosine = $\frac{\text{adjacent}}{\text{hypotenuse}}$	$\frac{5}{5.83} \approx .86$	$\frac{15}{17.49} \approx .86$	$\frac{10}{11.66} \approx .86$
Tangent = $\frac{\text{opposite}}{\text{adjacent}}$	$\frac{3}{5} = .6$	$\frac{9}{15} = .6$	$\frac{6}{10} = .6$

If the three ratios above are familiar to you, then continue with table 2.

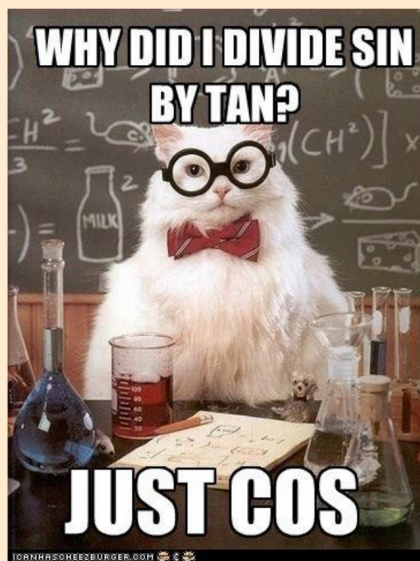
Investigate!(Solutions)

2) **Part 5:** Use resources to find defined ratios **Sin, cos, tan,....**
(**sec, csc, cot**)

3) **Label** the ratios in the table(s) with the **correct** trig. ratio.

Table 2 The remaining of the Six Trigonometric Ratios			
Cosecant = $\frac{\text{hypotenuse}}{\text{opposite}}$	$\frac{5.83}{3} \approx 1.94$	$\frac{17.49}{9} \approx 1.94$	$\frac{11.66}{6} = 1.94$
Secant = $\frac{\text{hypotenuse}}{\text{adjacent}}$	$\frac{5.83}{5} \approx 1.17$	$\frac{17.49}{15} \approx 1.17$	$\frac{11.66}{10} \approx 1.17$
Cotangent = $\frac{\text{adjacent}}{\text{opposite}}$	$\frac{5}{3} \approx 1.67$	$\frac{15}{9} \approx 1.67$	$\frac{10}{6} \approx 1.67$

Joke break!



I'll do algebra, I'll
do trig, and I'll
even do statistics,
but
graphing is where I
draw the line!



4) Practice, Apply trigonometric ratios!

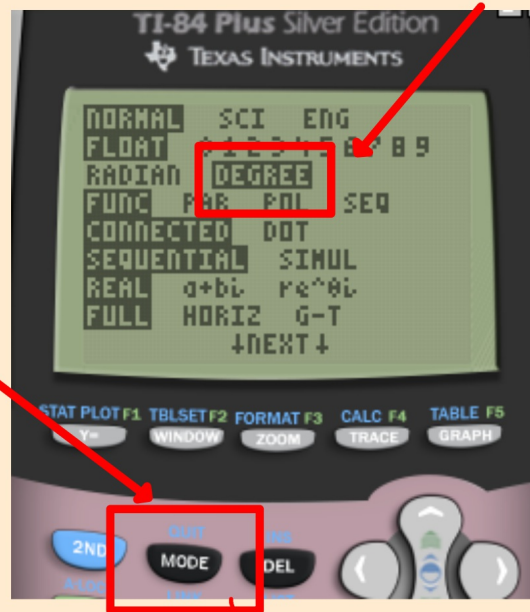
Practice!

1) Use your calculator to find the \sin , \cos , and \tan of 31° . Defend the accuracy of your estimations calculated in the tables above.

2) How can we find the ***sec***, ***csc***, and ***cot*** of 31° ? Compare your results to your estimations calculated in the tables above.

Using Right Triangle Trigonometry

MODE: DEGREE



4) Practice, Apply trigonometric ratios!

Solutions

Practice!

1) Use your calculator to find the sin, cos, and tan of 31° . Defend the accuracy of your estimations calculated in the tables above.

The values are the same! The rounding to 0.01 affected the accuracy of the ratios.

2) How can we find the sec, csc, and cot of 31° ? Compare your results to your estimations calculated in the tables above.

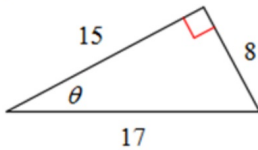
Use the x^{-1} button, AFTER using sin.

Example: $\sin 31^\circ \approx 0.515$, $\frac{1}{.515} \approx 1.94$ (sec 31°)

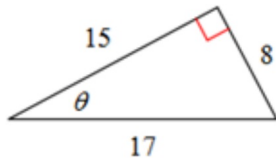
4) Practice, Apply trigonometric ratios!

3) Applying trigonometric ratios.

a) Find $\csc \theta$ and $\tan \theta$.



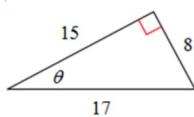
b) Use the triangle below to show that $\frac{\sec \theta}{\tan \theta} = \csc \theta$.



4) Practice, Apply trigonometric ratios! Solutions

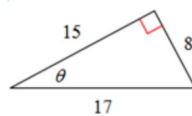
3) Applying trigonometric ratios.

a) Find $\csc \theta$ and $\tan \theta$.



$$\csc \theta = \frac{17}{8}$$
$$\tan \theta = \frac{8}{15}$$

b) Use the triangle below to show that $\frac{\sec \theta}{\tan \theta} = \csc \theta$.



Using Sidelengths:

$$\frac{\sec \theta}{\tan \theta} = \frac{17}{\frac{8}{15}} \rightarrow \frac{17}{15} \cdot \frac{15}{8} = \frac{17}{8} = \csc \theta$$

Using defined ratios:

$$\frac{\sec \theta}{\tan \theta} = \frac{\frac{\text{hyp}}{\text{adj}}}{\frac{\text{opp}}{\text{adj}}} \rightarrow \frac{\text{hyp}}{\text{adj}} \cdot \frac{\text{adj}}{\text{opp}} = \frac{\text{hyp}}{\text{opp}} = \csc \theta$$

Options for tonight's exercises...

"Trig is new to me."

13A page 253 # 1 & #2 & #1- #6 on
Trigonometric Ratios WS

"I have done trig before, but I need more practice."

Trigonometric Ratios WS #1 - #12

"I feel extremely comfortable with trig!"

Trigonometric Ratios WS #1 - #14

After-school help: Garages!

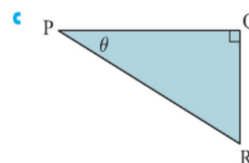
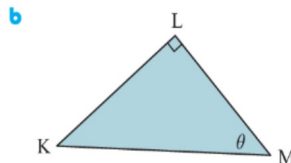
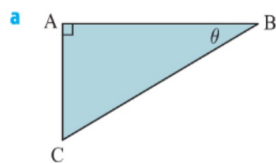
A**LABELLING RIGHT ANGLED TRIANGLES****Textbook Exercises**

1 For the triangles given, name the:

i hypotenuse

ii side opposite angle θ

iii side adjacent to θ .



2 For the triangles given, name the:

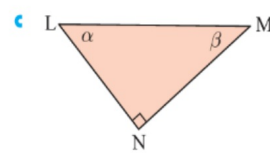
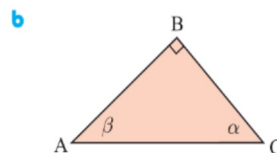
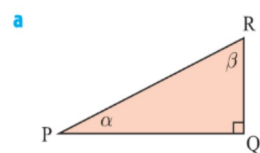
i hypotenuse

ii side opposite α

iii side adjacent to α

iv side opposite β

v side adjacent to β .



Solutions

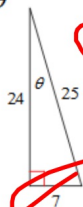
EXERCISE 13A

- | | | | | | | |
|----------|----------|---------------|----------------|-----------------|----------------|---------------|
| 1 | a | i [BC] | ii [AC] | iii [AB] | | |
| | b | i [KM] | ii [KL] | iii [LM] | | |
| | c | i [PR] | ii [QR] | iii [PQ] | | |
| 2 | a | i [PR] | ii [QR] | iii [PQ] | iv [PQ] | v [QR] |
| | b | i [AC] | ii [AB] | iii [BC] | iv [BC] | v [AB] |
| | c | i [LM] | ii [MN] | iii [LN] | iv [LN] | v [MN] |

Trigonometric Ratios Worksheet

Find the value of the trig function indicated.

1) $\cos \theta$



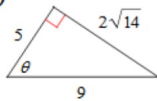
$$\cos \theta = \frac{\text{adj}}{\text{hyp}}$$

$$\cos \theta = \frac{24}{25}$$

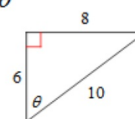
2) $\cot \theta$



3) $\sec \theta$

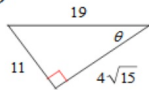


4) $\tan \theta$

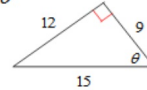


Trigonometric Ratios Worksheet

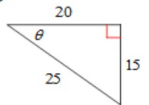
5) $\sin \theta$



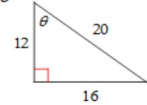
6) $\csc \theta$



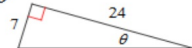
7) $\sin \theta$



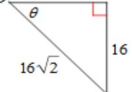
8) $\sec \theta$



9) $\csc \theta$

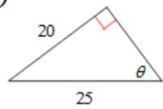


10) $\cot \theta$

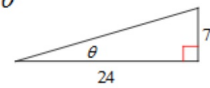


Trigonometric Ratios Worksheet

11) $\sec \theta$



12) $\sin \theta$



13) Show that $\frac{\tan x}{\sin x} = \sec x$.

14) Show that $\frac{\csc x}{\sec x} = \cot x$.

Trigonometric Ratios Worksheet

Solutions

Answers to Trigonometric Ratios (ID: 1)

1) $\frac{24}{25}$

2) $\frac{\sqrt{23}}{11}$

3) $\frac{9}{5}$

4) $\frac{4}{3}$

5) $\frac{11}{19}$

6) $\frac{5}{4}$

7) $\frac{3}{5}$

8) $\frac{5}{3}$

9) $\frac{25}{7}$

10) 1

11) $\frac{5}{3}$

12) $\frac{7}{25}$

13)

14)

Trigonometric Ratios Worksheet Solutions

#13) show that $\frac{\tan(x)}{\sin(x)} = \sec(x)$

$$\tan(x) = \frac{\sin(x)}{\cos(x)}$$

using substitution,

$$\begin{aligned}\frac{\sin(x)}{\cos(x)} \left(\frac{1}{\sin(x)} \right) &= \frac{\sin(x)}{\cos(x) \sin(x)} \\ &= \frac{1}{\cos(x)} \\ &= \sec(x)\end{aligned}$$

Trigonometric Ratios Worksheet Solutions

#14) show that $\frac{\csc(x)}{\sec(x)} = \cot(x)$

$$\csc(x) = \frac{1}{\sin(x)}$$

$$\sec(x) = \frac{1}{\cos(x)}$$

using substitution,

$$\frac{\csc(x)}{\sec(x)} = \frac{1}{\sin(x)} \left(\frac{\cos(x)}{1} \right) = \frac{\cos(x)}{\sin(x)} = \cot(x).$$