Special Triangles in Trigonometry

There are multiple ways to determine the side lengths on a right triangle. Using Special Triangle relationships is one of the easier ways. There is another way to use angles to find side lengths, though. It’s called **Trigonometry** and, unlike with Special Triangles, it **works for** **all right triangles**.

Trigonometry, at its most basic level, is the practice of using 3 types of fractions (Sine, Cosine, Tangent) to determine side lengths based on the angles across from them.

|  |  |  |
| --- | --- | --- |
| Sine | Cosine | Tangent |
| $$\sin(\left(angle\right))=\frac{opp}{hyp}$$ | $$\cos(\left(angle\right))=\frac{adj}{hyp}$$ | $$\tan(\left(angle\right))=\frac{opp}{adj}$$ |
| “Opp” stands for “opposite side,” and it is the label for the side that is across from the angle that you are focused on.“Adj” stands for “adjacent side,” and it is the label for the side that is **not** the hypotenuse or opposite the angle of focus.“Hyp” stands for “hypotenuse,” and it is the label for the side that is across from the 90˚ angle |

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  | Angles: | 30˚ | 60˚ | 90˚ |  |
|  | $$4$$ | $$4\sqrt{3}$$ | $$8$$ |  |
| Labels when **focused on 30˚**: | **OPP** | ADJ | HYP | $$\leftarrow 90˚ is always across from hyp.$$ |
| Labels when **focused on 60˚**: | ADJ | **OPP** | HYP | $$\leftarrow 90˚ is always across from hyp.$$ |
| CANNOT FOCUS ON 90˚ |  |  |  |  |
|  |  |  |  |  |  |
|   | Angles: | 45˚ | 45˚ | 90˚ |  |
|  | $$3$$ | $$3$$ | $$3\sqrt{2}$$ |  |
| Labels when **focused on 45˚**: | **OPP** | ADJ | HYP | $$\leftarrow 90˚ is always across from hyp.$$ |
| Labels when **focused on 45˚**: | ADJ | **OPP** | HYP | $$\leftarrow 90˚ is always across from hyp.$$ |
| CANNOT FOCUS ON 90˚ |  |  |  |  |

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
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| 1.

|  |  |  |  |
| --- | --- | --- | --- |
|  | 30˚ | 60˚ | 90˚ |
|  | $$4$$ | $$4\sqrt{3}$$ | $$8$$ |
| Focus on 30˚: |  |  |  |
| Focus on 60˚: |  |  |  |

 | Plug in the side values from the triangle, and simplify.***FOCUS ON 30˚***

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| $$\sin(\left(30˚\right))=$$ | OPP |  | $$\cos(\left(30˚\right))=$$ | ADJ |  | $$\tan(\left(30˚\right))=$$ | OPP |
|  | HYP |  |  | HYP |  |  | ADJ |
| $$\sin(\left(30˚\right))=$$ |  |  | $$\cos(\left(30˚\right))=$$ |  |  | $\tan(\left(30˚\right))$= |  |
|  |  |  |  |  |  |  |  |

***FOCUS ON 60˚***

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| $$\sin(\left(60˚\right))=$$ | OPP |  | $$\cos(\left(60˚\right))=$$ | ADJ |  | $$\tan(\left(60˚\right))=$$ | OPP |
|  | HYP |  |  | HYP |  |  | ADJ |
| $$\sin(\left(60˚\right))=$$ |  |  | $$\cos(\left(60˚\right))=$$ |  |  | $$\tan(\left(60˚\right))=$$ |  |
|  |  |  |  |  |  |  |  |

 |
| 2.

|  |  |  |  |
| --- | --- | --- | --- |
|  | 45˚ | 45˚ | 90˚ |
|  | $$3$$ | $$3$$ | $$3\sqrt{2}$$ |
| Focus on 45˚: |  |  |  |
| Focus on 45˚: |  |  |  |

 | Plug in the side values from the triangle, and simplify.***FOCUS ON 45˚***

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| $$\sin(\left(45˚\right))=$$ | OPP |  | $$\cos(\left(45˚\right))=$$ | ADJ |  | $$\tan(\left(45˚\right))=$$ | OPP |
|  | HYP |  |  | HYP |  |  | ADJ |
| $$\sin(\left(45˚\right))=$$ |  |  | $$\cos(\left(45˚\right))=$$ |  |  | $\tan(\left(45˚\right))$= |  |
|  |  |  |  |  |  |  |  |

***FOCUS ON 45˚***

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| $$\sin(\left(45˚\right))=$$ | OPP |  | $$\cos(\left(45˚\right))=$$ | ADJ |  | $$\tan(\left(45˚\right))=$$ | OPP |
|  | HYP |  |  | HYP |  |  | ADJ |
| $$\sin(\left(45˚\right))=$$ |  |  | $$\cos(\left(45˚\right))=$$ |  |  | $$\tan(\left(45˚\right))=$$ |  |
|  |  |  |  |  |  |  |  |

 |

Remember:

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| $$\sin(\left(angle\right))=$$ | OPP |  | $$\cos(\left(angle\right))=$$ | ADJ |  | $$\tan(\left(angle\right))=$$ | OPP |  |
|  | HYP |  |  | HYP |  |  | ADJ |  |

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
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| 3.

|  |  |  |  |
| --- | --- | --- | --- |
|  | 30˚ | 60˚ | 90˚ |
|  |  |  |  |
| Focus on 30˚: |  |  |  |
| Focus on 60˚: |  |  |  |

|  |  |
| --- | --- |
| $$\sin(\left(30˚\right))=$$ | $$\sin(\left(60˚\right))=$$ |
| $$\cos(\left(30˚\right))=$$ | $$\cos(\left(60˚\right))=$$ |
| $$\tan(\left(30˚\right))=$$ | $$\tan(\left(60˚\right))=$$ |

 | 4.

|  |  |  |  |
| --- | --- | --- | --- |
|  | 45˚ | 45˚ | 90˚ |
|  |  |  |  |
| Focus on 45˚: |  |  |  |
| Focus on 45˚: |  |  |  |

|  |  |
| --- | --- |
| $$\sin(\left(45˚\right))=$$ | $$\sin(\left(45˚\right))=$$ |
| $$\cos(\left(45˚\right))=$$ | $$\cos(\left(45˚\right))=$$ |
| $$\tan(\left(45˚\right))=$$ | $$\tan(\left(45˚\right))=$$ |

 |
| 5.

|  |  |  |  |
| --- | --- | --- | --- |
|  | 30˚ | 60˚ | 90˚ |
|  |  |  |  |
| Focus on 30˚: |  |  |  |
| Focus on 60˚: |  |  |  |

|  |  |
| --- | --- |
| $$\sin(\left(30˚\right))=$$ | $$\sin(\left(60˚\right))=$$ |
| $$\cos(\left(30˚\right))=$$ | $$\cos(\left(60˚\right))=$$ |
| $$\tan(\left(30˚\right))=$$ | $$\tan(\left(60˚\right))=$$ |

 | 6.

|  |  |  |  |
| --- | --- | --- | --- |
|  | 45˚ | 45˚ | 90˚ |
|  |  |  |  |
| Focus on 45˚: |  |  |  |
| Focus on 45˚: |  |  |  |

|  |  |
| --- | --- |
| $$\sin(\left(45˚\right))=$$ | $$\sin(\left(45˚\right))=$$ |
| $$\cos(\left(45˚\right))=$$ | $$\cos(\left(45˚\right))=$$ |
| $$\tan(\left(45˚\right))=$$ | $$\tan(\left(45˚\right))=$$ |

 |

Create the 3 trigonometry fractions for each angle.

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 7.

|  |  |  |  |
| --- | --- | --- | --- |
|  | 30˚ | 60˚ | 90˚ |
|  | $$8$$ | $$8\sqrt{3} $$ | $$16$$ |
| Focus on 30˚: |  |  |  |
| Focus on 60˚: |  |  |  |

 | 8.

|  |  |  |  |
| --- | --- | --- | --- |
|  | 45˚ | 45˚ | 90˚ |
|  | $$1$$ | $$1$$ | $$\sqrt{2}$$ |
| Focus on 45˚: |  |  |  |
| Focus on 45˚: |  |  |  |

 | 9.

|  |  |  |  |
| --- | --- | --- | --- |
|  | 30˚ | 60˚ | 90˚ |
|  | $$2$$ | $$2\sqrt{3}$$ | $$4$$ |
| Focus on 30˚: |  |  |  |
| Focus on 60˚: |  |  |  |

 |
| 10.

|  |  |  |  |
| --- | --- | --- | --- |
|  | 45˚ | 45˚ | 90˚ |
|  | $$13$$ | $$13$$ | $$13\sqrt{2}$$ |
| Focus on 45˚: |  |  |  |
| Focus on 45˚: |  |  |  |

 | 11.

|  |  |  |  |
| --- | --- | --- | --- |
|  | 30˚ | 60˚ | 90˚ |
|  | $$2\sqrt{3} $$ | $$6$$ | $$4\sqrt{3}$$ |
| Focus on 30˚: |  |  |  |
| Focus on 60˚: |  |  |  |

 | 12.

|  |  |  |  |
| --- | --- | --- | --- |
|  | 45˚ | 45˚ | 90˚ |
|  | $$4\sqrt{3}$$ | $$4\sqrt{3}$$ | $$4\sqrt{6}$$ |
| Focus on 45˚: |  |  |  |
| Focus on 45˚: |  |  |  |

 |
| 13.

|  |  |  |  |
| --- | --- | --- | --- |
|  | 30˚ | 60˚ | 90˚ |
|  | $$9\sqrt{5}$$ | $$9\sqrt{15}$$ | $$18\sqrt{5}$$ |
| Focus on 30˚: |  |  |  |
| Focus on 60˚: |  |  |  |

 | 14.

|  |  |  |  |
| --- | --- | --- | --- |
|  | 45˚ | 45˚ | 90˚ |
|  | $$\sqrt{7}$$ | $$\sqrt{7}$$ | $$\sqrt{14}$$ |
| Focus on 45˚: |  |  |  |
| Focus on 45˚: |  |  |  |

 | 15.

|  |  |  |  |
| --- | --- | --- | --- |
|  | 30˚ | 60˚ | 90˚ |
|  | $$\sqrt{7}$$ | $$\sqrt{21}$$ | $$2\sqrt{7}$$ |
| Focus on 30˚: |  |  |  |
| Focus on 60˚: |  |  |  |

 |
| 16.

|  |  |  |  |
| --- | --- | --- | --- |
|  | 45˚ | 45˚ | 90˚ |
|  | $$3\sqrt{2}$$ | $$3\sqrt{2}$$ | $$6$$ |
| Focus on 45˚: |  |  |  |
| Focus on 45˚: |  |  |  |

 | 17.

|  |  |  |  |
| --- | --- | --- | --- |
|  | 30˚ | 60˚ | 90˚ |
|  | $$\sqrt{3}$$ | $$3$$ | $$2\sqrt{3}$$ |
| Focus on 30˚: |  |  |  |
| Focus on 60˚: |  |  |  |

 | 18.

|  |  |  |  |
| --- | --- | --- | --- |
|  | 45˚ | 45˚ | 90˚ |
|  | $$3\sqrt{5}$$ | $$3\sqrt{5}$$ | $$3\sqrt{10}$$ |
| Focus on 45˚: |  |  |  |
| Focus on 45˚: |  |  |  |

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