Math Notes

Trigonometry

What is trigonometry?

- From up to what we have learnt, it helps us find sides of the right-angled triangle given only one side and one angle other than the right angle.
- It is similar to Pythagoras' theorem that it is used to find the value of sides of a right-angled triangle.
- It can also be used to find the angles given two sides of the triangle.
- Only for right-angled triangles.
- It uses ratio of the sides.
- THIS TOPIC USES DEGREE MODE. MAKE SURE YOU ARE NOT IN RADIAN MODE.

Right-angled Triangle and their sides

- There are three sides to a triangle.
- A reference angle can be determined anyhow, but it can be either of the interior angles of the triangle that is not the right-angled triangle.
- The side opposite the right-angle is called the hypotenuse.
- The side opposite the reference angle is called the opposite.
- The side that has the right-angle and the reference angle on it is called the adjacent.
- An example is the figure on the right.
  Angle a is the reference angle in this case.
  Opposite of the right-angle is the hypotenuse.
  Opposite of the reference angle is the opposite.
  The included side between the reference angle and the right-angle is the adjacent.

Functions

- Tangent
  Tangent is used to find the ratio of the opposite to the adjacent.
- Cosine
  Cosine is used to find the ratio of the adjacent to the hypotenuse.
- Sine
  Sine is used to find the ratio of the opposite to the hypotenuse.
- The order of the ratio CANNOT be changed.
- A way to remember the functions and their functions is to remember this statement.
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Math Notes

Finding the sides

- Again, we will be using the triangle on the right side, with values put in to it.
- Using the functions, we can determine the values of the different sides.
- This section would require a calculator to work with.
- tan a = opposite/adjacent = bc/ac
- cos a = adjacent/hypotenuse = ac/5
- sin a = opposite/hypotenuse = bc/5
- However, we do not know the value of the opposite and the adjacent, how do you find it?
  Use your calculator, press the functions and followed by the angle.
- Working #1) Opposite
  $\sin 30^{\mathbf{o}} = bc/ab = bc/6$
  $6 \sin 30^{\mathbf{o}} = bc$
  $bc = 6 \sin 30^{\mathbf{o}} = 3$
  Opposite = bc = 3
- Now we have found the opposite, lets find the adjacent.
- There are two ways to finding the adjacent, that is, using tangent or cosine. I will be doing both.
- Working #2) Adjacent (Tangent)
  $\tan 30^{\mathbf{o}} = bc / ac = 3/ac$
  $1/\tan 30^{\mathbf{o}} = ac/3$
  $3/\tan 30^{\mathbf{o}} = ac$
  $ac = 3/\tan 30^{\mathbf{o}} = 5.196152... = 5.20$ (3 sig. fig.)
  Adjacent = ac = 5.20 (3 sig. fig.)
- Working #3) Adjacent (Cosine)
  $\cos 30^{\mathbf{o}} = ac/ab = ac/6$
  $6 \cos 30^{\mathbf{o}} = ac$
  $ac = 6 \cos 30^{\mathbf{o}} = 5.196152... = 5.20$ (3 sig. fig.)
  Adjacent = ac = 5.20 (3 sig. fig.)
- Now we managed to find the sides. What if we do not know the angles?

Math Notes

Finding the angles

- Once again we'll be using the triangle at the side.
- Using a new set of functions, we are able to find the unknown angles with the ratios.
- This section, as well, requires a calculator to work with.
- To obtain the new functions, simply input shift/2nd F and the corresponding function.
- The functions in question is arctangent, arccosine and arcsine. (the corresponding functions with a -1 on the top right corner.)
- So, now we know the new functions, let's find the angles with all the functions.
- All angles to be rounded to 1 decimal point.
- Working #1) Finding Angle a (Tangent & Arctangent)
  tan a = opposite/adjacent = 4/3
  a = arctan 4/3 = 53.13... = $53.1^{\mathbf{o}}$ (1 d.p.)

- Working #2) Finding Angle a (Cosine & Arccosine)
  cos a = adjacent/hypotenuse = 3/5
  a = arccos 3/5 = 53.13... = $53.1^{\mathbf{o}}$ (1 d.p.)

- Working #3) Finding Angle a (Sine & Arcsine)
  sin a = opposite/hypotenuse = 4/5
  a = arcsin 4/5 = 53.13... = $53.1^{\mathbf{o}}$ (1 d.p.)

- Working #4) Finding Angle b (Tangent & Arctangent)
  tan b = opposite/adjacent = 3/4
  b = arctan 3/4 = 36.86... = $36.9^{\mathbf{o}}$ (1 d.p.)

- Working #5) Finding Angle b (Cosine & Arccosine)
  cos b = adjacent/hypotenuse = 4/5
  b = arccos 4/5 = 36.86... = $36.9^{\mathbf{o}}$ (1 d.p.)

- Working #6) Finding Angle (Sine & Arcsine)
  sin b = opposite/hypotenuse = 3/5
  b = arcsin 3/5 = 36.86... = $36.9^{\mathbf{o}}$ (1 d.p.)