WIND STUDY

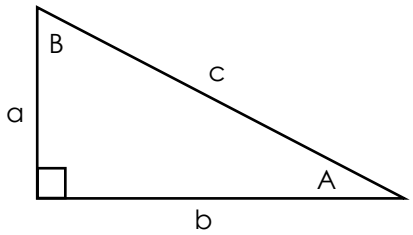
Wind Study is intended for grades 5-8 and 8-11
Questions posted on: Monday Answers posted on: Friday
Find downloadable one pagers at www.oneenergy.com/one-energy-feed

2024 Q2

TORSION & FASTENERS

Hello students! When we are building our projects here at One Energy, we use a wide variety of fasteners. Fasteners hold materials or objects together, such as a screw, bolt, nail, or rivet. Today we are going to look at how rotated fasteners like bolts and screws are used, and more specifically, what force we apply that gives them their fascinating fastening ability.

When we push an object, we apply force upon it. If we apply force, and it makes the object rotate, then we have also applied torque. Torque is a rotational force proportional to the distance from an object's center of rotation. That is why tools with longer handles are capable of applying more torque with the same input force.



$$Torque = Force * Distance\ to\ Center\ of\ Rotation \qquad \text{or} \qquad T = Fr$$

$$\text{Sin}(A) = \frac{a}{c} \qquad \tan(A) = \frac{a}{b} \qquad \cos\left(\frac{b}{c}\right)^{-1} = A$$

$$\text{Cos}(A) = \frac{b}{c} \qquad a^2 + b^2 = c^2$$

This equation of torque assumes that you are applying the force perpendicular to the radius of rotation, if you apply the force at an angle, you will need to use trigonometry to calculate the equivalent perpendicular load.

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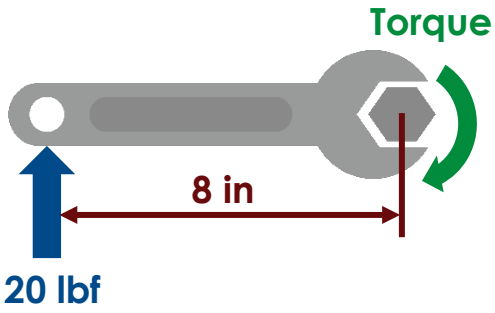
Level 1 Question: If you apply 20 pounds of force to the end of an 8-inch-long wrench to turn a bolt as shown in the image below, how many pound-force-inches of torque did you transmit onto that bolt? How long would your wrench need to be to transmit 1000 pound-force-inches of Torque onto the bolt using the same force?



Level 2 Question: If you apply 20 pounds of force to the end of an 8-inch-long wrench to turn a bolt (as shown in the left image), how many pound-force-inches of torque did you transmit onto that bolt? If you apply 100 pounds of force to a 14-inch-long wrench (as shown in the right image), what angle would you have to apply the force to generate 500 pound-force-inches of torque?