

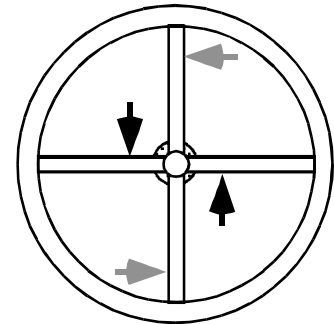
PHYZ SPRINGBOARD: THE SCREWDRIVER



Screwdrivers come in many different sizes. Some are short and stubby, some are tall and thin. Some are better for certain jobs than others.

Suppose you have a stubborn screw that just won't loosen. What's the best tool for *that* job? To determine an answer, consider the following.

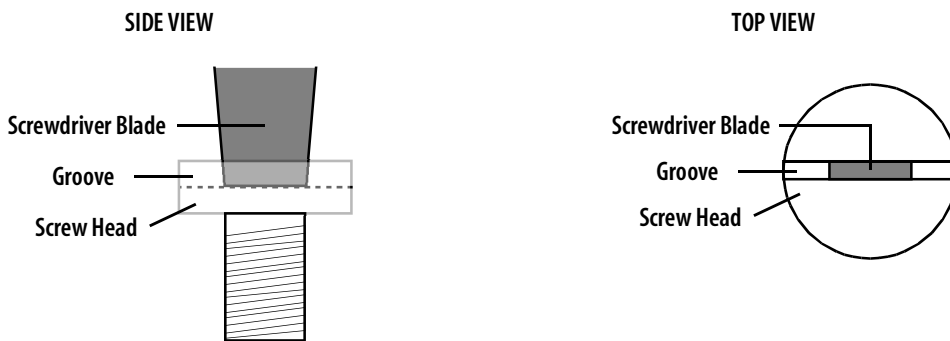
1. Which is the better location to apply a pair of forces to rotate the big bank vault knob: the positions shown by the black arrows, or the positions shown by the gray arrows? Circle the arrows corresponding to the greater torque and cross out those for the lesser torque.



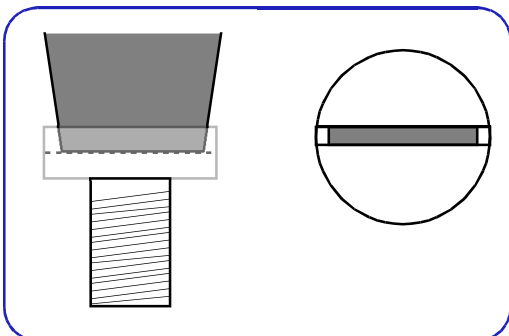
2. Why will forces at the selected positions produce more torque than forces at the other positions?

Greater lever arm produces more torque.

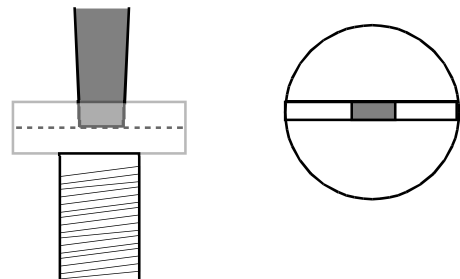
3. The diagram below shows a side view and a top view of a screw and a screwdriver blade. On the TOP VIEW, circle the points at which the screwdriver blade exerts forces on the screw head to produce torque.



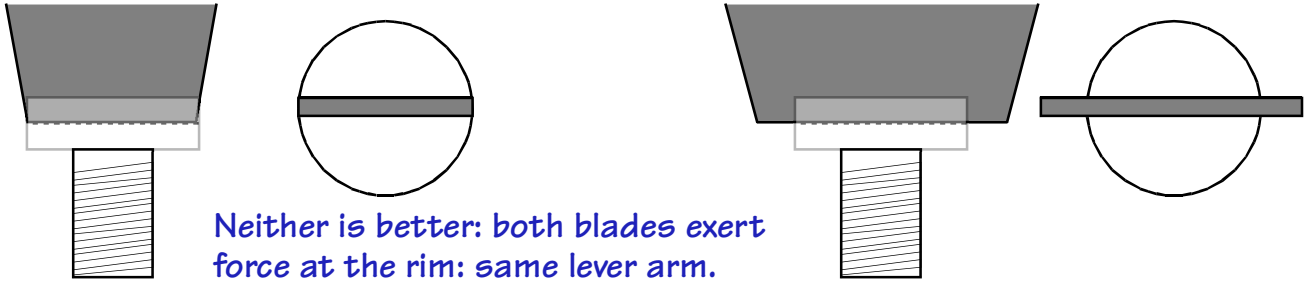
4. Which screwdriver will be more effective in loosening the stubborn screw: the one with a wide blade or the one with a narrow blade? Explain.



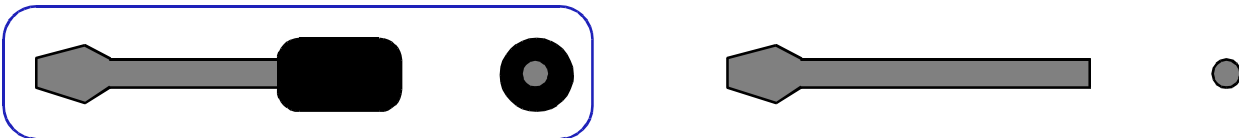
Blade exerts force on screwhead farther from the axis of rotation. Greater lever arm produces more torque.



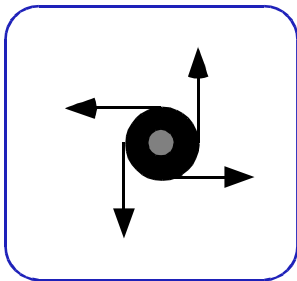
5. Which—if either—screwdriver would be more effective in loosening a screw: one with a blade as wide as the screw's groove or one with a blade wider than the screw's groove? Explain.



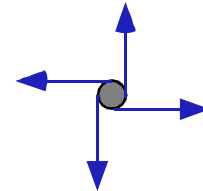
6. But what about the other end of the screwdriver? Which—if either—is a more effective tool: a screwdriver with a handle or one without a handle?



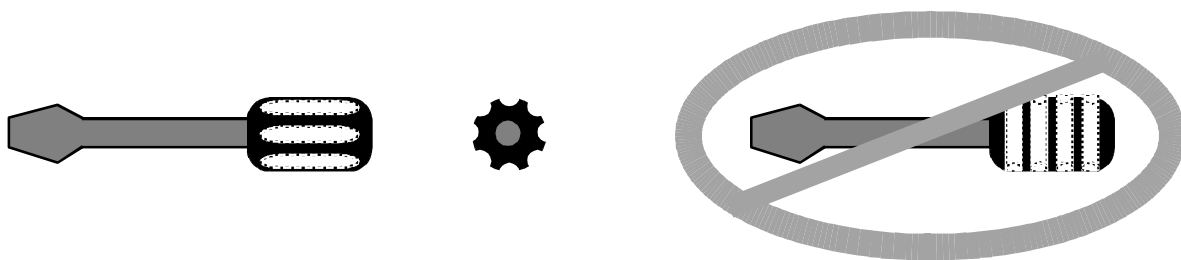
7. Shown below are end-view diagrams of two screwdrivers: one with a handle and one without. Also shown are force vectors representing friction forces that a hand would apply on the screwdriver with a handle. Draw these vectors on the other screwdriver and determine which will experience more torque with this friction force.



Force is exerted at greater lever arm distance.



8. One last thing. Why do they put those ridges in the handle? Why are the ridges parallel to the stem instead of perpendicular?



Flesh of hand presses into the ridges and helps apply tangential force to turn the screwdriver.