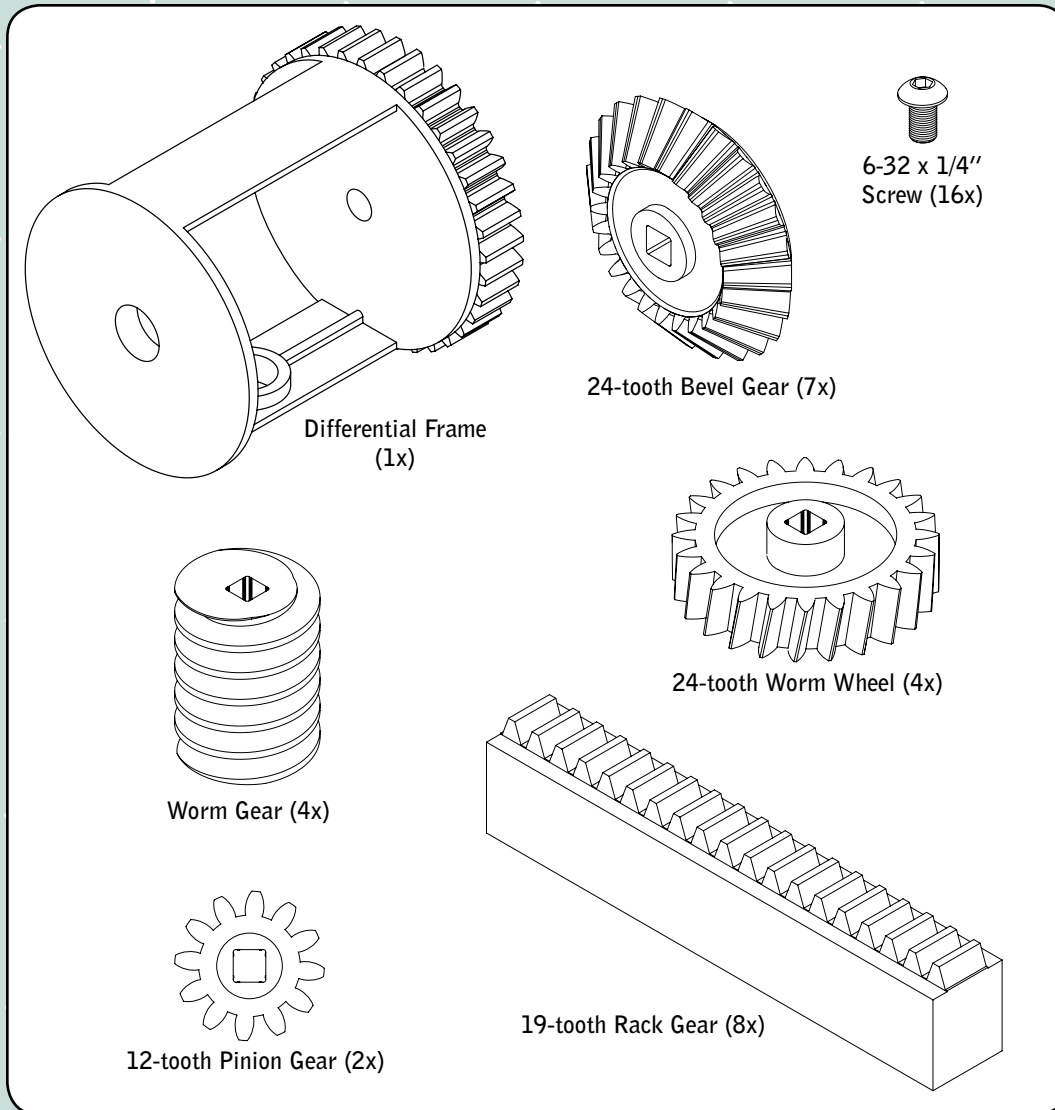


## advanced gear kit

This kit provides several options for advanced motion. The kit consists of 4 main sub-components: bevel-gears, rack-and-pinions, worm-gears, and a differential. These parts allow advanced mechanical Vex designers to create new ingenious mechanisms.

**INSERT THIS PAGE**  
at the **back of the**  
**Motion Chapter** in your  
Vex Inventor's Guide.



Limited 90-day Warranty  
This product is warranted  
by Innovation First against  
manufacturing defects in material  
and workmanship under normal use  
for ninety (90) days from the date of  
purchase from authorized Innovation  
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dealer.

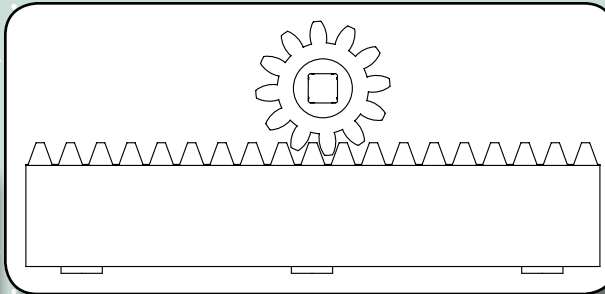
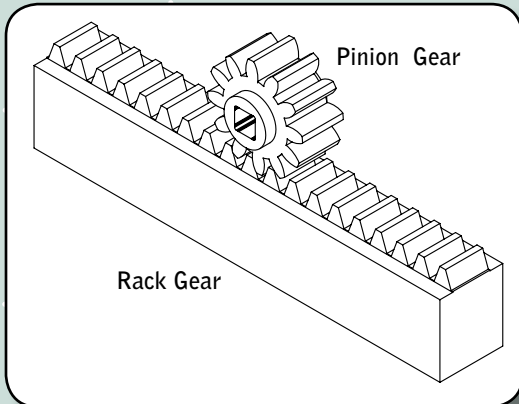
Innovation First, Inc.  
1519 IH 30 W  
Greenville, TX 75402

06/07

### advanced gear kit, continued

The first set of components in this kit is the Rack & Pinion setup. The rack gears included in this kit can be used to create linear motion. These rack gears can be attached to any Vex metal component (using the included 6-32 screws), and driven by any Vex spur gear (there are two 12-tooth pinion spur gears included in this kit).

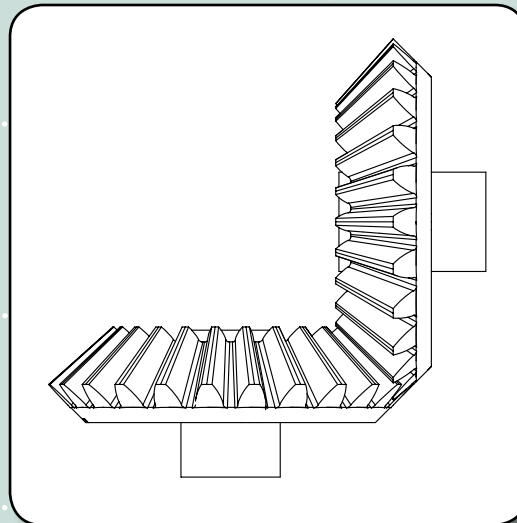
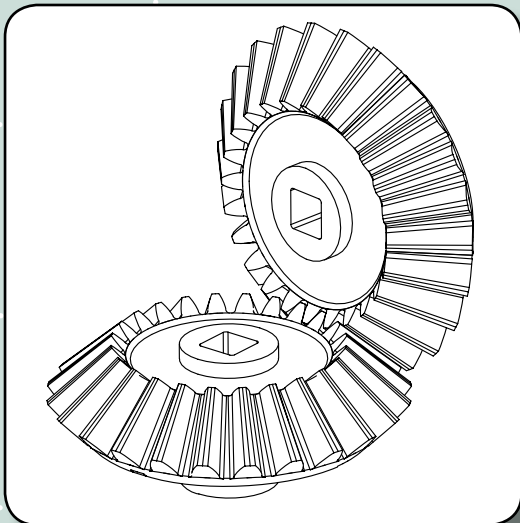
As the pinion gear rotates, the rack gear will slide linearly. This allows users to create linear motion.



Note, for every rotation of the shaft, the rack gear will advance a number of teeth equal to that of the pinion. So for a 12 tooth pinion gear, 1 rotation will advance the rack gear by 12 teeth.

The rack gear consists of 19 teeth, and is 2.5" long. This means for every 19 teeth it advances, it will move 2.5" linearly.

Another component found in the advanced gear kit is a bevel gear. Bevel gears can be used to transmit motion "around corners" in 90° angles. This is useful for many applications.

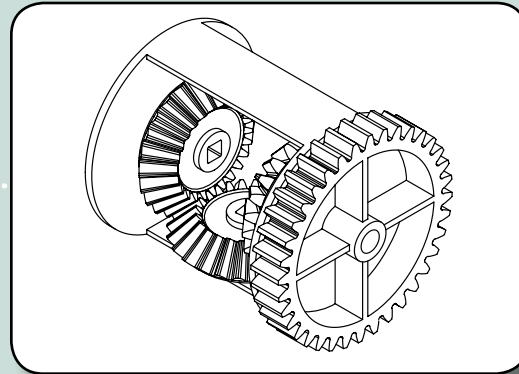
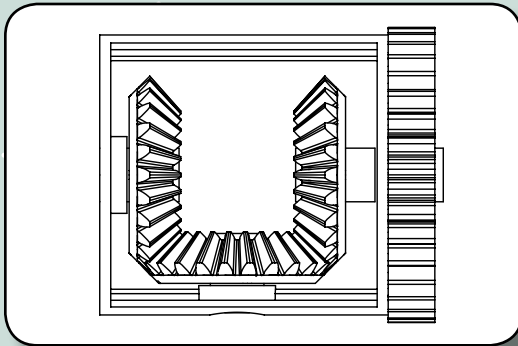


All the bevel gears included in this kit have 24-teeth. This results in a 1-to-1 reduction (the output shaft spins with the same speed & torque of the input shaft.)

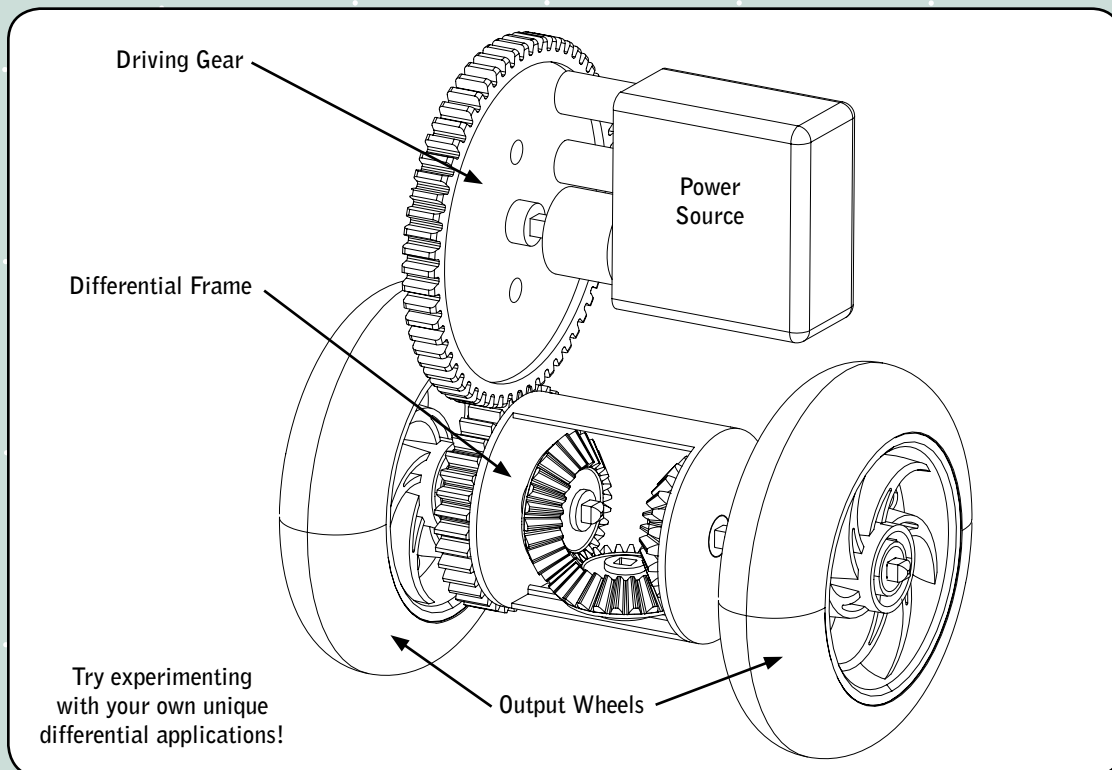
### advanced gear kit, continued

The bevel gears can also be used in conjunction with the differential frame to create a differential. Simply install (3x) of the bevel gears into the differential frame as shown. Two of the bevel gears will snap into sockets in the plastic differential housing, the third bevel gear must be held in place by a Vex shaft.

Note: you may need to bend the frame slightly during installation to get everything snapped into place.



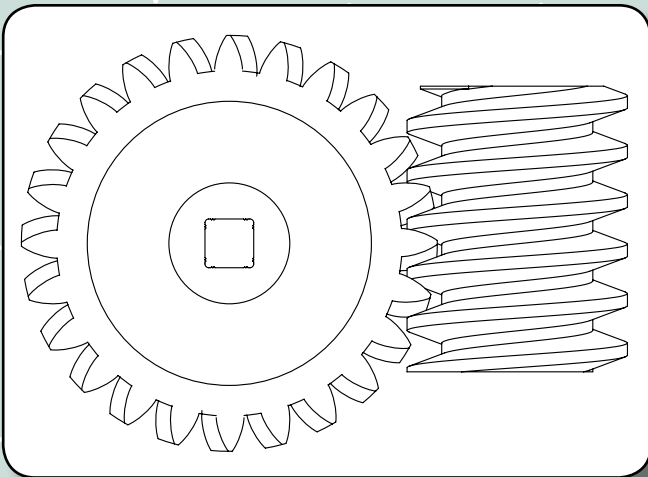
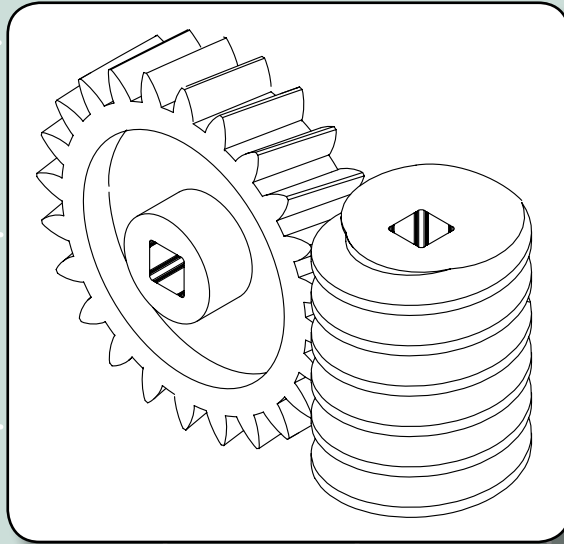
Once the gears are installed, you can then integrate this differential assembly into your robot to allow for "car-style" rear drive. When a car turns one rear wheel moves in a larger arc than the other wheel. The wheel on the outside of the turn needs to move further (and spin faster) than the wheel on the inside of the turn. The differential allows both of these wheels to be driven from a single power-source, and still allows them to spin at different rates in a turn. Though differentials have many uses, this is the most common.



### advanced gear kit, continued

The final component of the advanced gear kit is the worm-gear. Worm gears are useful for several reasons.

- Like the bevel gears, they offset motion 90 degrees.
- Worm-gear drives also resist “back-driving”, if you try to use a worm-wheel to drive a worm-gear, it won’t work! The driving force must be applied to the worm gear.
- This resistance to back-driving can be very useful in any number of robot applications.
- Worm gears will also provide a high amount of reduction, in a relatively compact package.



The worm-wheel included in the Vex advanced gear kit has 24-teeth. For every full revolution of the worm-gear, the worm wheel will advance 1-tooth ( $1/24^{\text{th}}$  of a revolution). This means, the worm-gear must spin 24 times before the worm-wheel will complete a single revolution.