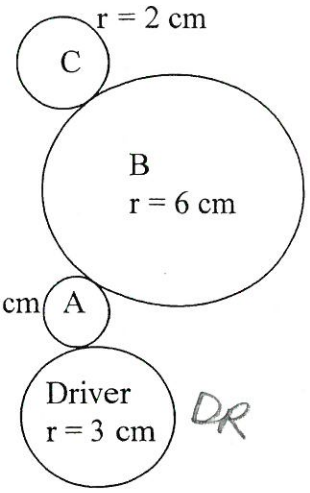
AST 406

Speed Change in Motion Transmission Systems

1. Consider the friction gears on the right.



   a. What is the speed ratio of gear A? $A = \frac{3cm}{1cm} = 3 \times DR$

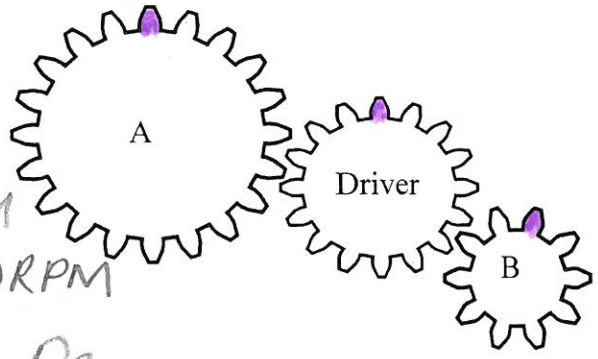
   b. What is the speed ratio of gear B? $B = \frac{3cm}{6cm} = \frac{1}{2} \times DR$

   c. What is the speed ratio of gear C? $C = \frac{3cm}{2cm} = \frac{3}{2} \times DR$

   d. Which gear will be the fastest? smallest = A

   e. Which gear will be the slowest? biggest = B

2. Consider the gear train illustrated below. The driver gear rotates at a rate of 500 RPM.



   a. What is the rotation speed of gear A?

$$\text{speed } A = \frac{DR}{A} \times \text{speed } DR$$

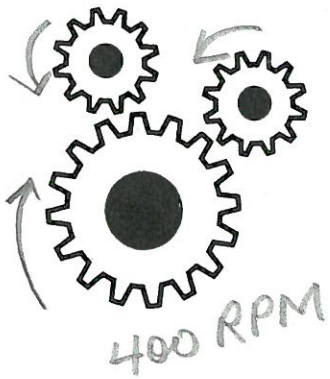
$$= \frac{16 \text{ teeth}}{20 \text{ teeth}} \times 500 \text{ RPM} = 400 \text{ RPM}$$

   b. What is the rotation speed of gear B?

$$\text{speed } B = \frac{DR}{B} \times \text{speed } DR$$

$$= \frac{16 \text{ teeth}}{10 \text{ teeth}} \times \text{speed } 500 \text{ RPM} = 800 \text{ RPM}$$

3. In the gear train below, the larger gear rotates in the clockwise direction at a rate of 400 RPM. What is the speed and direction of rotation of the two small gears?



$$\text{speed small} = \frac{DR}{\text{small}} \times \text{speed } DR$$

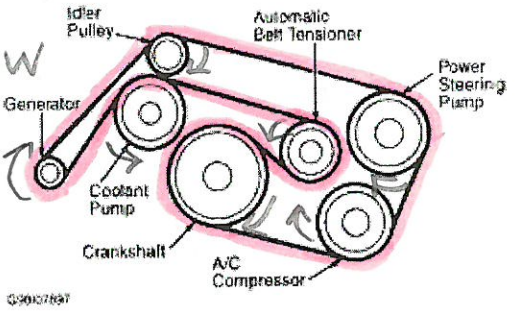
$$= \frac{16 \text{ teeth}}{12 \text{ teeth}} \times 400 \text{ RPM}$$

$$= 533 \text{ RPM}$$

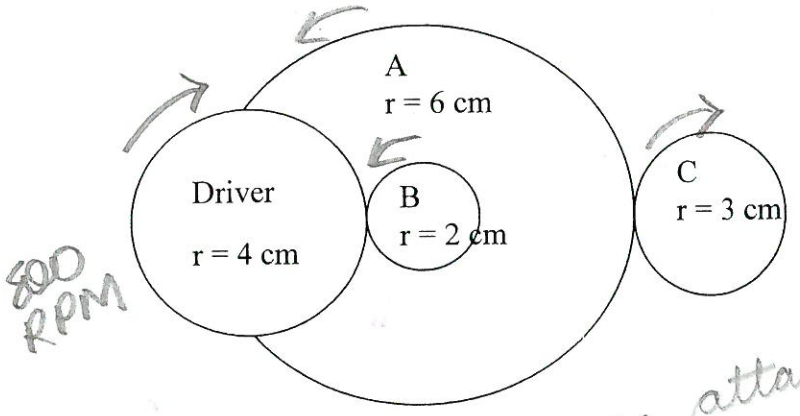
inside

4. The illustration below shows the belt system for a car. Assume that the generator rotates in the clockwise direction. Give the direction of each part

Idler Pulley: inside = CW
Automatic Tensioner: outside = CCW
Power Steering Pump: inside = CW
A/C Compressor: inside = CW
Crankshaft: inside = CW
Coolant Pump: outside = CCW



5. Consider the friction gears below. The driver gear rotates in the clockwise direction at a rate of 800 RPM. Find the speed and direction of rotation of every other gear.



A + B are attached
∴ same direction

$$\text{speed } B = \frac{DR}{DN} \times \text{speed } DR$$

$$= \frac{4\text{cm}}{2\text{cm}} \times 800 \text{ RPM}$$

$$= 1600 \text{ RPM} = \text{speed } A$$ bec A attached to B

$$\text{Speed } C = \frac{DR}{DN} \cdot \text{speed } DR$$

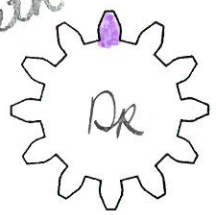
$$= \frac{4\text{cm}}{3\text{cm}} \times 800 \text{ RPM}$$

$$= 1067 \text{ RPM}$$

6. The gear illustrated below is used as a driver gear. Another gear will be added next to this gear.

$\frac{D_R}{D_N} = \frac{3}{1} = \frac{D_R \text{ teeth}}{D_N \text{ teeth}}$ 12 teeth

$D_N \text{ teeth} = \frac{D_R \text{ teeth}}{3}$



$\frac{D_R}{D_N} = \frac{3}{1} = \frac{12 \text{ teeth}}{x}$

a. How many teeth should the second gear have if we want the speed ratio to be 3? $= \frac{3}{1} = \frac{D_R}{D_N}$

$= \frac{12 \text{ teeth}}{3} = 4 \text{ teeth}$

b. How many teeth should the second gear have if we want the speed ration to be 0.75?

0.75 x the speed $= \frac{12 \text{ teeth}}{0.75} = 16 \text{ teeth}$

∴ bigger

c. How many teeth should the second gear have if we want the speed ratio to be 0.1?

$= \frac{12 \text{ teeth}}{0.1} = 120 \text{ teeth}$

7. In the space below, draw a motion transmission system that satisfies all of the following criteria:
   - The driver gear rotates at a rate of 200 RPM. = 10 cm
   - One gear rotates at a rate of 100 RPM. = 20 cm = 1/2 the speed of DR
   - One gear rotates at a rate of 600 RPM. = 3.3 cm = 3x the speed of DR
   - One gear rotates at a rate of 400 RPM, and this gear rotates in the same direction as the driver gear. = 5 cm = 2x speed of DR

   Note: your diagram does not need to be to scale, but you must indicate the size or number of teeth of each component.