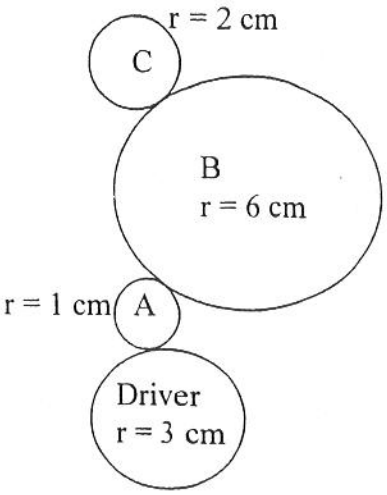
Key

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?

$$S.R. = \frac{r\ driver}{r\ A} = \frac{3cm}{1cm} = 3$$

   b. What is the speed ratio of gear B?

$$S.R. = \frac{r\ driver}{r\ B} = \frac{3cm}{6cm} = \frac{1}{2}$$

   c. What is the speed ratio of gear C?

$$S.R. = \frac{r\ driver}{r\ C} = \frac{3cm}{2cm} = 1.5$$

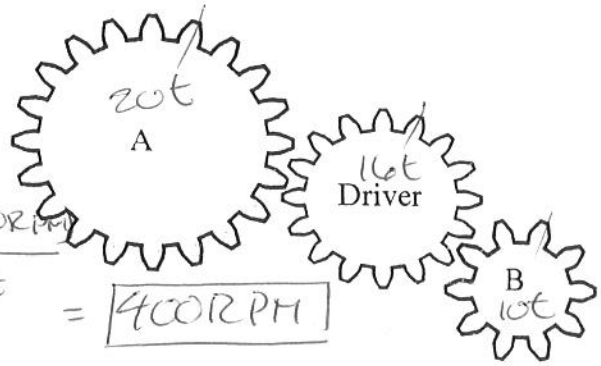
   d. Which gear will be the fastest?

A (smallest)

   e. Which gear will be the slowest?

B (largest)

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?

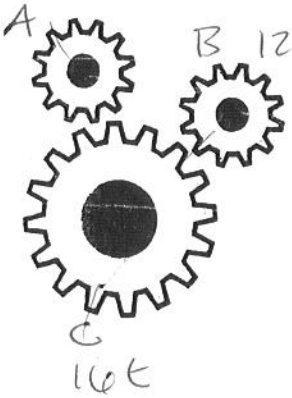
$$\frac{Sp\ dn}{Sp\ dr} = \frac{t\ dr}{t\ dn}$$

$$Sp\ dn = \frac{(t\ dr)(Sp\ dr)}{t\ dn} = \frac{(16t)(500RPM)}{20t} = \boxed{400RPM}$$

   b. What is the rotation speed of gear B?

$$Sp\ dn = \frac{t(dr)(Spdr)}{t\ dn} = \frac{(16t)(500RPM)}{10t} = \boxed{800\ RPM}$$

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?



A and B have same speed because the have same size.

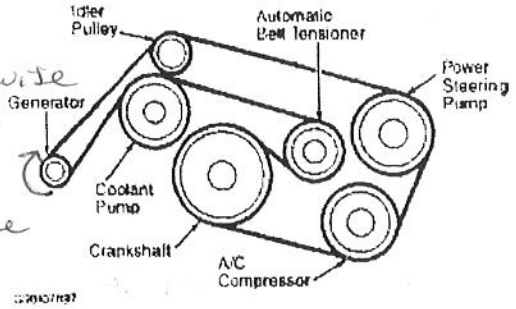
$$\frac{Sp\ A}{Sp\ C} = \frac{t\ C}{t\ A}$$

$$Sp\ A = \frac{(t\ C)(Sp\ C)}{t\ A} = \frac{(400RPM)(16t)}{12t}$$

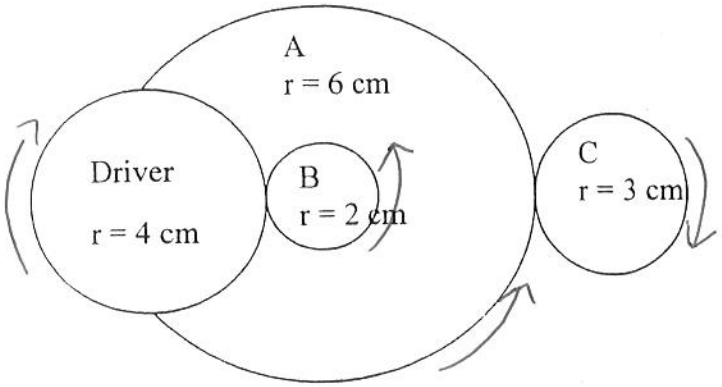
$$= \boxed{533\ RPM}$$

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: clockwise
Automatic Tensioner: counterclockwise
Power Steering Pump: clockwise
A/C Compressor: clockwise
Crankshaft: clockwise
Coolant Pump: counterclockwise



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 and B same speed because same axle!

① Driver → B

$$\frac{Sp\ B}{Sp\ dr} = \frac{r\ dr}{r\ B}$$

$$Sp\ B = \frac{(r\ dr)(Sp\ dr)}{r\ B}$$

$$= \frac{(4cm)(800RPM)}{2cm}$$

$$= 1600\ RPM$$

② Speed A = 1600 RPM.

(same as B)

③ A → C

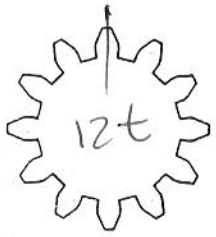
$$\frac{Sp\ C}{Sp\ A} = \frac{r\ A}{r\ C}$$

$$Sp\ C = \frac{(r\ A)(Sp\ A)}{r\ C}$$

$$= \frac{(6cm)(1600RPM)}{3cm}$$

Speed C = 3200 RPM clockwise

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



a. How many teeth should the second gear have if we want the speed ratio to be 3?

$3 = \frac{12}{x} \rightarrow x = 14$ teeth

$S.12 = \frac{\text{teeth dr}}{\text{teeth dn}}$

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

$0.75 = \frac{12}{x} \rightarrow x = \frac{12}{0.75} = 16$ teeth

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

$0.1 = \frac{12}{x} \rightarrow x = \frac{12}{0.1} = 120$ 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.
   - One gear rotates at a rate of 100 RPM.
   - One gear rotates at a rate of 600 RPM.
   - One gear rotates at a rate of 400 RPM, and this gear rotates in the same direction as the driver gear.

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