Question 1

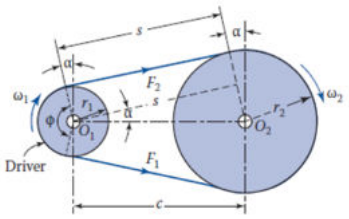
For the purposes of power transmission complete the following table, inserting at least one point in each cell of the table.

	Flat Belt	V belt	Chain
Advantage			
Disadvantage			
Example application			

Solution

Answers from reading material.

Question 2



- For the pulley above, write the equations that allow you to calculate;
  - Net force
  - Torque of the largest pulley
  - Power transmitted
- Show that belt length can be calculated;

$$L = 2[c^2 - (r_2 - r_1)^2]^{\frac{1}{2}} + r_1(\pi - 2\alpha) + r_2(\pi + 2\alpha)$$

Solution

```
% net force
% F_n = F_1 - F_2

% Torque on the largest pulley
% T = (F_1 - F_2) * r

% Power transmitted by the belt
% P = (F_1 - F_2) * V
% where; V = (pi * D * N) / 60

% Belt length
```

```
%
% phi_small = pi - 2 * alpha
%
% phi_large = pi + 2 * alpha
%
% sin(alpha) = (r_2 - r_1) / c
%
% Putting the above together;
% L = 2 * sqrt(c^2 - (r_2 -r_1)^2) + r_1 * (pi - 2 * alpha) + r_2 * (pi +
2 * alpha)
```

Question 3

A flat belt 60 mm wide and 0.5 mm thick transmits 10 kW from the driven pulley of radius 25 mm to the driven pulley of radius 75mm.

Calculate;

- The torque at the small pulley
- The length of the belt if the center distance between pulleys is 1200mm

Solution

```
% Calculating the torque at the small pulley

% Since no speed is given we can calculate algebraicly

% P = T * w = T * n / 60 * 2 * pi
% T = 10000 / (n / 30 * pi)
% T = 30000/pi * n


% Calculating the length of the belt
r_1 = 25/1000;   %[m]
r_2 = 75/1000;   %[m]
c = 1200/1000;   %[m]

alpha = asind(r_2 - r_1) / c;
L = 2 * sqrt(c^2 - (r_2 -r_1)^2) + r_1 * (pi - 2 * alpha) + r_2 * (pi + 2
* alpha)
```

```
L = 2.9509
```

Question 4

A 8950W, 2200 rpm electric motor drives a machine using a flat belt. The size of the belt is 127 mm wide and 7.62 mm thick and it weighs 113 kg/m^3

The center distance is equal to 2m. The pulley on the motor shaft has a radius of 64mm and the driven pulley has a radius of 190mm.

- **Find:** The belt tensions (minimum and maximum).
- **Assumption:** The coefficient of friction is f=0.2

Solution

```
clear all;

d_1 = 0.127;      %[m]
n_1 = 2200;       %[rpm]
P = 8950;         %[W]
w = 113;          %[kg/m^3]
g = 9.81;         %[m/s^2]
f = 0.2;          %[]
r_1 = 0.064;      %[m]
r_2 = 0.190;      %[m]
c = 2;            %[m]

% velocity
V = (pi * d_1 * n_1) / 60       %[m/s]
```

```
V = 14.6293
```

```
% net force
% P = (F_1 - F_2)V    [eq 1]

% F = F_1 - F_2
% F = P / V
% belt centrifugal force
% F_c = w / g * V^2

F_c = w / g * V^2
```

```
F_c = 2.4652e+03
```

```
% belt wrap angle
alpha = asind(r_2 - r_1) / c;
phi = 180 - 2 * alpha
```

```
phi = 172.7615
```

```
% calculating forces
% (F_1 - F_c) / (F_2 - F_c) = e^(f * phi)    [eq2]

% Solving using eq1 and eq2
F_1 = (F_c + P / V - exp(f * phi * pi / 180) * F_c) / (1 - exp(f * phi *
pi / 180))
```

```
F_1 = 1.7261e+03
```

```
% Substituting back into eq1
F_2 = (F_1 * V - P) / V
```

```
F_2 = 1.1143e+03
```