Engineering worked examples

Practice exercises solutions:

1. The performance version of the Tesla electric car has a maximum power output of 310 (kW) and a maximum torque of 600 (Nm). Given the power equation above, what would be the electric motor speed at maximum power and torque in revolutions per minute or rpm?

Angular velocity $\omega = \frac{P}{T} = \frac{310 \times 1000W}{600Nm} = 516.7$ radians/sec. To convert to revolutions per minute we know that 1 rev=$360^o = 2\pi$ radians hence $\omega = \frac{516.7}{2\pi} = 82.2$ rev/sec. To find this latter figure in revs/minute we use that there are 60 seconds in each minute leading to $\omega = 82.2 \times 60 = 4933$ rev/min.

2. A domestic solar power installation requires 3 kW of solar capacity made up of 250 W panels with dimensions of 1027 mm x 1695 mm (Tindo Solar Karra-250). What would be the minimum roof area required to install this system?

Area of one panel = $1027x1695 = 1740765mm^2$ or $1.74m^2$
Number of panels required $= total\ watts/watts\ per\ panel = 3000W/250W = 12$ panels
Total area required $= 12 \times 1.74m^2 = 20.9m^2$

3. To install a swimming pool, a hole must be excavated 20 m long x 7 m wide x 2.5 m deep. Calculate the volume of soil that must be removed from the site?

Volume $= l \times w \times h = 20x7x2.5 = 350\ m^3$

4. Calculate the surface area required for a thermal blanket to cover the water surface of the pool in Q3.

Area of blanket $= l \times w = 20x7 = 140\ m^2$