Acceleration

1. Write the formula of **acceleration**.

$$a = \frac{v - u}{t}$$

2. The velocity of the car increased from 4 m/s to 32 m/s in 7 seconds. Calculate its **acceleration**.

u = 4 m/s, v= 32 m/s, t= 7 s, a=?

$$a = \frac{v-u}{t} = \frac{32-4}{7} = 4\ m/s^{2}$$

3. The car accelerated from a speed of 10 m/s for 10 seconds at an acceleration of 3 m/s^2. Calculate **the final velocity.**

u = 10 m/s, v= ? m/s, t= 10 s, a= 3 m/s^2

$$v = a\ t + u$$

$v = a\ t + u$ = 3 x 10 + 10 =40 m/s

4. A runner accelerated from rest and reached a speed of 9 m/s in first 3 seconds. **Calculate the acceleration.**

u = 0 m/s, v= 9 m/s, t= 3 s, a= ?

$$a = \frac{v-u}{t} = \frac{9-0}{3} = 3\ m/s^{2}$$

5. A car moving at a velocity of 36 m/s brakes and stop in 12 s. **Calculate its deceleration.**

u = 36 m/s, v= 0 m/s, t= 12 s, a= ?

$$a = \frac{v-u}{t} = \frac{0-36}{12} = -3\ m/s^{2}$$

6. A rocket launched into space burns its fuel for the first 6 minutes and then turns off its engines. Afterward, it continues moving through space at a speed of 15,000 m/s. What is **the rocket's acceleration** during the first 6 minutes?

u = 0 m/s, v= 15,000 m/s, t= 6 min = 6x60 =360 s, a= ?

$$a = \frac{v-u}{t} = \frac{15000-0}{360} = 41.67\ m/s^{2}$$

7. The Moon is approximately 384400 km from Earth. **How long** will it take the rocket to reach the Moon?

The first 6 minutes the rocket moved with the acceleration. Therefore, the distance covered before the engines switched off is:

$S = ut + \frac{1}{2} a t^2$

$S = ut + \frac{1}{2} a t^2 = 0 \times 360 + \frac{1}{2} x\, 41.67\, x\, 360^{\,2} = 2{,}700{,}216$ m

Afterward, the rocket travelled with the constant velocity v=15,000 m/s.

384,400 km = 384,400,000 m

Distance covered with the constant speed:

384,400,000 – 2,700,216 =381,699,784 m

Time till the moon from the moment the engines are switched off:

$t = \frac{d}{v} = \frac{381699784}{15000} = 25{,}446.65\ s$

The total time from the Earth to Moon:

t_{total} = 360 + 25446.65 = <u>26,046.65 s</u>

8. Alpha Centauri is the nearest star, located approximately 4.1×10^{13} km away. Could this rocket transport a person to Alpha Centauri before he/she die of old age?

4.1×10^{13} km = 4.1×10^{16} m

Time needed to reach Alpha Centauri:

$t = \frac{s}{v} = \frac{4.1\, x\, 10^{16}}{15000} = 2.67\, x\, 10^{12}$ s = 84,559.45 years

People cannot live that long, so the person will die before the rocket reaches the star.