How to use calculator

Some simple examples

$2 \times e^5$

2 [X] [SHIFT] [ln] (e^x) 5 [=]

$1.2 \times 10^3 = 1200$

1.2 [X] 10 [^] 3 [=]

log 1000 = 3

[log] 1000 [=]

ln 90

[ln] 90 [=]

Some simple examples

$\frac{2}{3} + \frac{1}{5} = 0.866$

(2 ÷ 3) + (1 ÷ 5) =

$\cos^{-1} \frac{\sqrt{2}}{2} = 45$

SHIFT cos (√ 2 ÷ 2) =

$\tan^{-1} 0.741 = 36.53844577°$

SHIFT tan 0.741 =

$\log 1.23 = 0.089905111$

log 1.23 =

$e^{10} = 22026.46579$

SHIFT e^x 10 =

Some simple examples

$10^{1.5} = 31.6227766$

SHIFT 10^x 1.5 =

$123 + 30^2 = 1023$

123 + 30 x^2 =

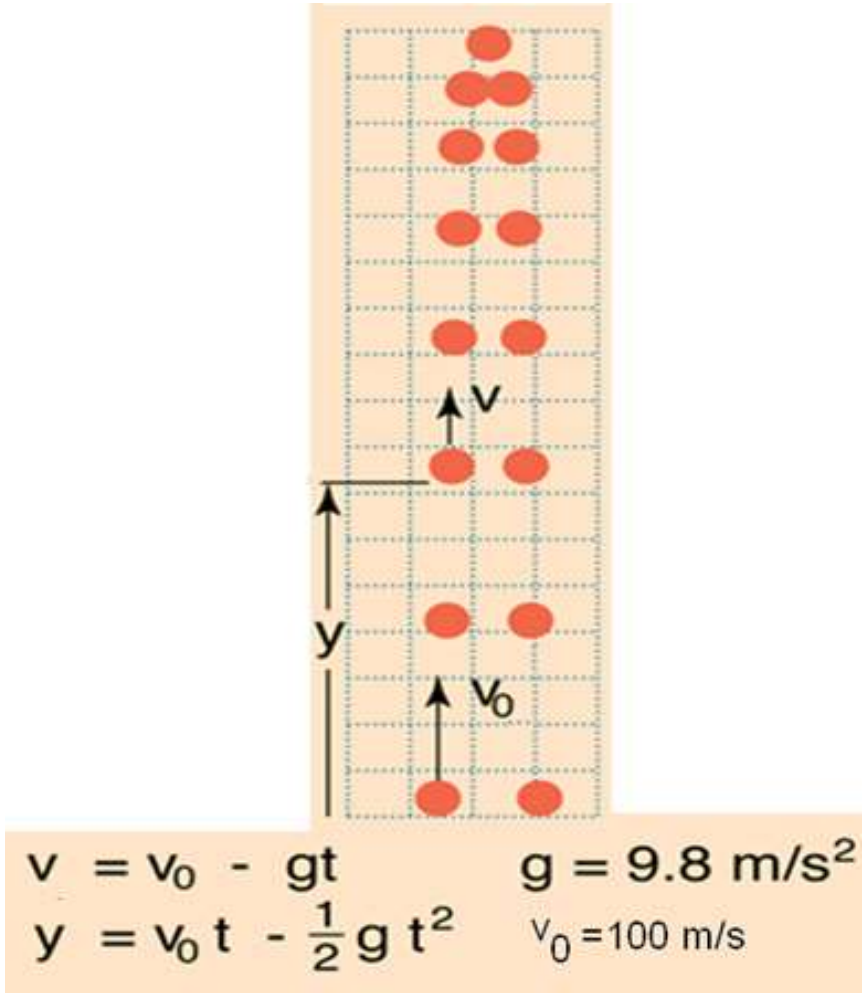
$2^4 = 16$

2 ^ 4 =

$\sqrt{2} + \sqrt{3} \times \sqrt{5} = 5.287196909$

$\sqrt{}$ 2 + $\sqrt{}$ 3 × $\sqrt{}$ 5 =

An example for free fall



- Value of height at t=4s?
- Value of velocity at t=8s?
- t_{up}=? (t_{ascent})
- t_{flight}=?
- h_{max}=?
- Total distance during flight?

(Exercise: solve for the initial velocity v0=90 m/s)

Value of height at t=4s?

- For the height at t=4s, we need to insert t=4 in the formula of y

$$y = v_0 t - \frac{1}{2} g t^2$$

$$y = 100 \times 4 - \frac{1}{2} \times 9.8 \times 4^2 = 321.6 \text{ m}$$

- In calculator result can be calculated as follow

100 × 4 − (1 ÷ 2) × 9.8 × 4 x^2 =

or using parenthesis for the first term

(100 × 4) − (1 ÷ 2) × 9.8 × 4 x^2 =

(Exercise: solve for t=6 and 8 s)

Value of velocity at t=8s

- For the velocity at t=8s, we need to insert t=8 in the formula of v

$$v = v_0 - gt$$

$$v = 100 - 9.8 \times 8 = 21.6 \text{ m/s}$$

- In calculator result can be calculated as follow

100 − 9.8 × 8 =

or using parenthesis for the second term

100 − (9.8 × 8) =

(Exercise: solve for t=4 and 8 s)

t_{up}=?

- The value of velocity at maximum height is 0. Time needed to reach maximum height can be found by inserting v=0 in velocity time formula

$$v = v_0 - gt$$

- In calculator result can be calculated as follow

$$t_{up} = \frac{v_0}{g} = \frac{100}{9.8} = 10.204 \quad sn$$

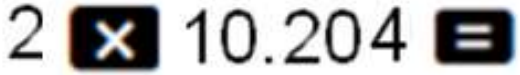
100 ÷ 9.8 =

t_{flight}=?

- When finding the flight time, it should be known that it will land in the time it takes for ascent. In this case, the flight time is twice the ascent time.

$$t_{flight} = 2x t_{up} = 2x10.204 = 20.408 \text{ sn}$$

- In calculator result can be calculated as follow



$h_{max}=?$

- In the y formula when finding the maximum height

$$y = v_0 t - \frac{1}{2} g t^2$$

t is replaced by the time of ascent to the maximum height.

- On the calculator it is calculated as follows

$$h_{max} = 100 \times 10.204 - \frac{1}{2} \times 9.8 \times 10.204^2 = 510.204 \text{ m}$$

100 × 10.204 − (1 ÷ 2) × 9.8 × 10.204 x^2 =

100xt$_ç$ $\frac{1}{2} \times 9.8 \times t_ç^2$

or bracketing the first term

(100 × 10.204) − (1 ÷ 2) × 9.8 × 10.204 x^2 =

100xt$_ç$ $\frac{1}{2} \times 9.8 \times t_ç^2$

Total distance during flight?

- When finding the distance during the flight time t is replaced by the flight time in the formula of y

$$y = v_0 t - \frac{1}{2} g t^2$$

- On a calculator, it is calculated as follows

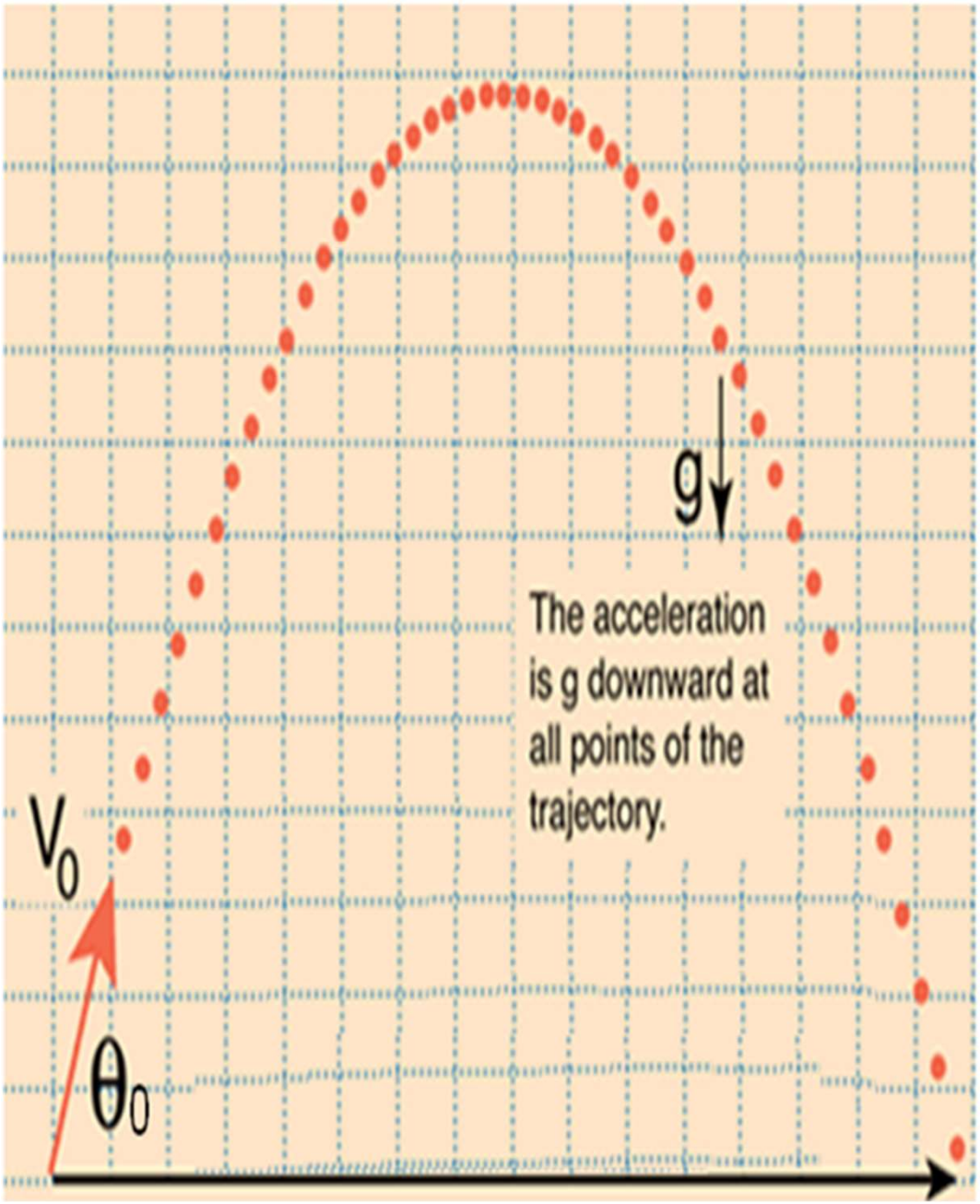
$$h_{max} = 100 \times 20.408 - \frac{1}{2} \times 9.8 \times 20.408 = 0$$

100 × 20.408 − (1 ÷ 2) × 9.8 × 20.408 x^2 =

or using parenthesis for the first term

(100 × 20.408) − (1 ÷ 2) × 9.8 × 20.408 x^2 =

An example for projectile motion



$v_{0x}=v_0\cos\theta_0$ $v_{0y}=v_0\sin\theta_0$

horizontal motion

$a_x=0$ $v_x=v_{0x}$ (i.e. constant velocity motion) $x=v_{0x}\times t$

Düşey hareket

$a_y=-g$ $v_y=v_{0y}-gt$ $y=v_{0y}t-\frac{1}{2}gt^2$

$v=\sqrt{v_x^2+v_y^2}$

up

$t_{up}=\frac{v_{0y}}{g}=\frac{v_0\sin\theta_0}{g}$ $t_{flight}=2\times t_{up}=\frac{2v_0\sin\theta_0}{g}$

$h_{max}=\frac{(v_0\sin\theta_0)^2}{2g}$ $Menzil=v_{0x}\times t_{flight}=\frac{v_0^2\sin 2\theta_0}{g}$

Question: A projectile with an initial velocity of 100 m/s is thrown at an angle of θ0=53 degrees.

- The x and y components of the initial velocity (v0x and v0y)
- Time of ascent to maximum height and time to fall to the ground after being thrown
- Maximum height it can reach
- Range
- Height and horizontal position at t=4 seconds
- horizontal and vertical components of the velocity at t=6 seconds
- The value of the speed at t=6 seconds

(Exercise: solve it for 80 m/s initial speed and 60-degree throw angle).

x and y components of the initial velocity(v_{0x} and v_{0y})

v_0=100 ve θ_0=53 $v_{0x}=v_0\cos\theta_0$ $v_{0y}=v_0\sin\theta_0$

v_{0x}=100 x cos53=60.182 m/s v_{0y}=100 x sin53=79.853 m/s

On a calculator, it is calculated as follows

v_{0x}= 100 × cos 53 = v_{0y}=100 × sin 53 =

The time of ascent to maximum height (t_{up}) and the time it takes to fall to the ground after being thrown?

To find the output time, v_0=100 and θ_0=53 are substituted in the expression of

$$t_{up} = \frac{v_{0y}}{g} = \frac{v_0 \sin\theta_0}{g} = \frac{100 \times \sin 53}{9.8} = 8.149 \text{ sn}$$

On the calculator

(100 × sin 53) ÷ 9.8 =

The time it takes to fall to the ground after being thrown is twice the ascent time

2 x 8.149 = 16.298 sn 2 × 8.149 =

h_{max}=?

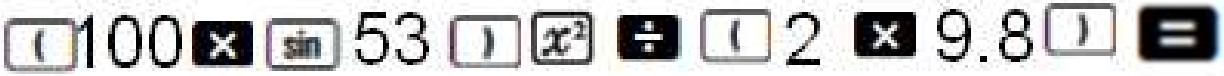
- When finding the maximum height, it can reach

We can substitute v_0=100 and θ_0=53 in the formula of

$$h_{max} = \frac{(v_0 \sin\theta_0)^2}{2g}$$

$$h_{max} = \frac{(v_0 \sin\theta_0)^2}{2g} = \frac{(100 \times \sin 53)^2}{2 \times 9.8} = 325.418\ \text{m}$$

On a calculator, it is calculated as follows

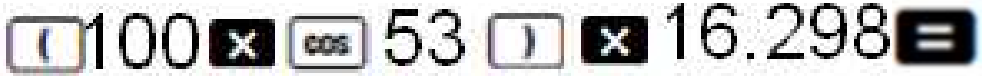


Range, i.e. the distance it will travel horizontally in flight time?

To find the range, we must $t=t_{flight}$ in the formula of range

$$\text{Range} = v_{0x} \times t_{flight} = (100 \times \cos 53) \times 16.298 = 980.838$$

In the calculator, it is calculated as follows.



Height and horizontal position at t=4 seconds

The height and horizontal position at t=4 s are calculated with the following formulas.

$$y=v_{0y}t-\frac{1}{2}gt^2$$

$$x=v_{0x}\times t$$

$$y=v_{0y}t-\frac{1}{2}gt^2=(100x\sin 53)x4-\frac{1}{2}\ 9.8x4^2=241.054m$$

$$x=v_{0x}\times t\ =(100*\cos 53)x4=240.726\ m$$

On the calculator

Horizontal and vertical components of the velocity at t=6 seconds

At t=6 seconds the horizontal component of the velocity is the same as the horizontal component of the initial velocity because there is constant speed motion horizontally. Its value is found as follows

$v_x = v_{0x} = 60.18$ m/s constant velocity motion

100 × cos 53 =

The vertical component of the velocity is calculated by the following formula

$v_y = v_{0y} - gt = 100 \times \sin 53 - (9.8 \times 4) = 40.66$ m/s

(100 × sin 53) − (× 9.8 × 4) =

(Exercise: solve for t=4 and 8 sec)

The value of the speed at t=6 seconds

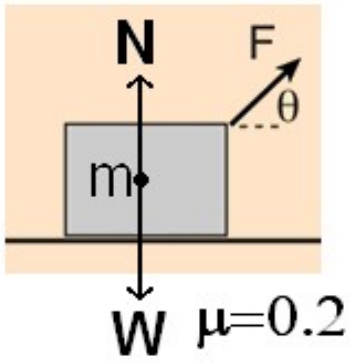
The value of the velocity at t=6 s is calculated as follows using the data given in the previous slide.

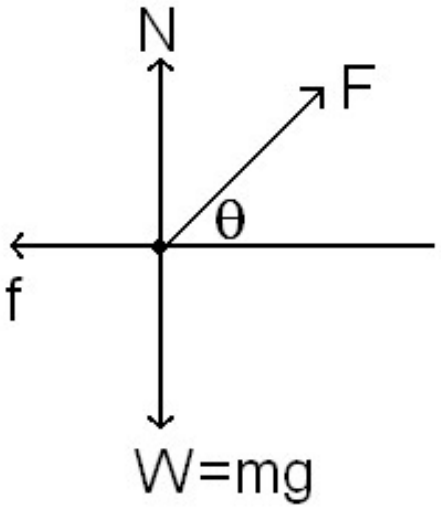
$$v=\sqrt{v_x^2+v_y^2} = \sqrt{60.18^2+40.66^2} = 72.628 \text{ m/s}$$

With a calculator, it can be calculated as follows

(Exercise: solve for t=4 and 8 sec)

Motion in Horizontal Frictional Surface





A box of mass m=20 kg is pulled by a force of F=100 N at an angle$\theta=53^{o}$ with the horizontal.

a) What is the acceleration of the case

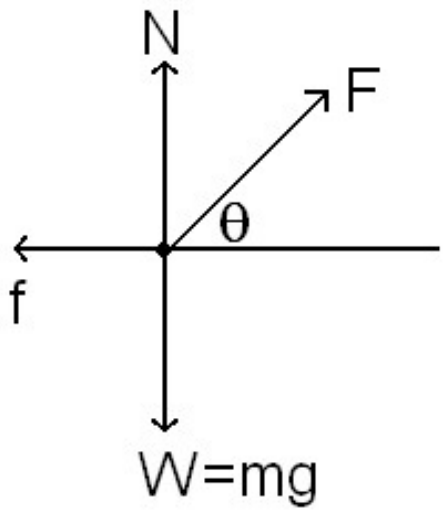
b) Find the position and velocity after 6 seconds, since the frame is in stationary motion.

(Exercise 1: Solve for F=200 N and θ=45)

(Exercise2: Solve for F=200 N and θ=0)

Acceleration?

Since the box does not move in the vertical direction, the following equation can be written with the help of the free body diagram.



$$\Sigma F_y = 0$$

$$N + F\sin 53 = W$$

$$N = W - F\sin 53$$

$$N = mg - F\sin 53$$

$$N = 20 \times 9.8 - 100 \times \sin 53 = 116.136 \text{ N}$$

(20 × 9.8) - (100 × sin 53)

If the box is in the horizontal direction, it moves to the right side under the influence of the horizontal component of the force F and the friction force.

$$\Sigma F_x = ma \longrightarrow F_x - f = ma$$

$$F\cos 53 - \mu N = ma \longrightarrow 100\cos 53 - 0.2 \times 116.136 = 20a$$

$$36.954 = 20a$$

$$a = 1.848 \text{ m/s}^2$$

(100 × cos 53) − (0.2 × 116.136 =

Position and speed in 6 seconds?

Finding the position at 6 seconds is as follows

$$x = \frac{1}{2}at^2 = \frac{1}{2} \times 1.848 \times 6^2 = 33.264 \text{ m}$$

The following operation is done with a calculator.

To find the speed at t=6 seconds, the following operations are done.

$$v = at = 1.848 \times 6 = 11.088 \text{ m/s}$$

The following operation is done with the calculator.

(Exercise: Solve for t=4 and 8 s)

Some Unit Conversion Examples

0.05 mega = ... nano
6 mili = ... mikro

0.05 mega = 0.05×10^{15} nano
6 mili = 6×10^{3} mikro

7 nano = ... giga
50 nano = ... tera

7 nano = 7×10^{-18} giga
50 nano = 50×10^{-21} tera

10 cm/h^2 = ... m/s^2
100 kg/m^3 = ... g/cm^3

$$10\frac{cm}{hr^2}\times\frac{1hr}{3600\,s}\times\frac{1hr}{3600\,s}\times\frac{1m}{100\,cm}=772\times10^{-11}\frac{cm}{s^2}$$

$$100\frac{kg}{m^3}\times\frac{1000g}{1kg}\times\frac{1m^3}{1000000cm^3}=0.1\frac{g}{cm^3}$$