INTRODUCTION OF QUADRATIC EQUATIONS IN SOLVING PRACTICAL PROBLEMS OF PHYSICS

I.Makhmudov, M.Safarova
Academic lyceum of SamSU
The teacher of school number 60

Annotation

Mathematics is fundamental part of applied physics, in particular, mathematical quadratic equations are broadly implemented to reach the solutions of problems in physics therefore, it is highly recommended for physics teachers to understand and apply quadratic applications in order to huddle with physical problems in theory and practice.

Key words: quadratic equations, physical quartiles, basic physical formulae, physical units.

The requirement of today`s education is to utilize modern pedagogical technologies in teaching physics at schools and academic lyceums.
The crucial function of any subject is to increase learners` academic skills, to enable them to use gained theoretical knowledge outside the classroom, to rise their awareness of the subject. The chosen problems to be solved in practical physics should not only make learners be able to find solutions, but also to use them in real life. So, the notion "Quadratic equations" in mathematics can be noticed in solving practical problems in physics. There are lots of ways and methods of solving practical problemsof physics. If there are two possible satisfying solutions, quadratic equations are often chosen.

"Solving problems" is a medium of acquiring the system of scientific knowledge and notions. The process of solving problems is of great importance in gaining knowledge and practical skills.

Problem 1. The object is thrown at a speed of $\upsilon_1=4\ m/s$ from the air balloon which is $h_1=40\ m$ high from the earth, which has a speed of $\upsilon_2=6\ m/s$. How much time does it take from the object to reach the earth? What is the h2 height of the air balloon at this time?

Let it be:

$\upsilon_1=4m/s,\ \upsilon_2=6m/s,\ h_1=40m,\ g=10m/s^2$

t-? h_2-?

Solution:

The movement of the object in the h height from the earth with a smooth acceleration at any t time can be expressed by the following formula, considering the object thrown from the air balloon as $\vartheta_0=\vartheta_1+\vartheta_2$:

$$h = h_1 + \vartheta_0 t - \frac{gt^2}{2} = h_1 + (\vartheta_1 + \vartheta_2)t - \frac{gt^2}{2}$$

Consider that *h=0* when the object reaches to the earth:

$$\frac{gt^2}{2} - (\vartheta_1 + \vartheta_2)t - h_1 = 0$$

The last form of the equation is as the same as $ax^2 + bx + c = 0$.

$$a = g\,, b = -2(\vartheta_1 + \vartheta_2)\,,\ c = -2h_1$$

$$D = 4\left[(\vartheta_1 + \vartheta_2)^2 + 2gh_1\right] = 4(100\frac{m^2}{s^2} + 2\cdot 10\frac{m}{s^2}\cdot 40m) = 3600\frac{m^2}{s^2}$$

if the time – *t* is found, $t_1 = 4s$, $t_2 = -2s$ is an extra value, which does not exist in reality. As *t* – the time is negative, it does not physical meaning. Therefore, the time at which the object reaches the ground *is t=4s.*

The answer is $t=4s$, $h_2 = 56m$.

Problem 2. 1/3 part of the glass tube whose length is *60cm*, both ends of which is open,is steeped into the dish of mercury. The upper end of the glass tube is closed and is taken from the mercury. How long is the mercury column in the glass tube? Atmospheric pressure is equal to 10^5 *Pa.*

Let it be:

$l = 60cm = 0{,}6m$, $l_0 = \frac{2}{3}l = 0{,}4m$, $P_0 = 10^5\ Pa$, $\rho = 13600\frac{kg}{m^3}$, $g = 10\frac{m}{s^2}$

Δl -?

Solution:

If we use Boyl-Mariot`s Law:

$$P_0V_0 = PV \Rightarrow P_0\cdot S\cdot l_0 = (P_0 - \rho\cdot g\cdot\Delta l)\cdot S(l - \Delta l) \Rightarrow P_0\cdot S\cdot\frac{2}{3}l = (P_0 - \rho\cdot g\cdot\Delta l)\cdot S(l - \Delta l)$$

$$\Rightarrow$$

$$\frac{2}{3}lP_0 = P_0 l - P_0\Delta l - \rho\cdot g\cdot\Delta l + \rho\cdot g\Delta l^2 \Rightarrow 3\rho\cdot g\Delta l^2 - 3(P_0 + \rho\cdot g\cdot l)\Delta l + P_0 l = 0$$

The final form of the equation is $ax^2 + bx + c = 0$ which is quadratic equation:

$$a = 3\rho\cdot g\,, b = -3(P_0 + \rho\cdot g\cdot l)\,,\ c = P_0\cdot l$$

$$\Delta l_{1,2} = \frac{3(P_0 + \rho\cdot g\cdot l) \pm \sqrt{9(P_0 + \rho\cdot g\cdot l)^2 - 4\rho\cdot g\cdot 3P_0 l}}{2\cdot 3\cdot\rho\cdot g}$$

We have to find the root of the equation using numeral value of given physical units.

$$\Delta l_{1,2} = \frac{3(10^5 Pa + 13600\frac{kg}{m^3}\cdot 10\frac{m}{s^2}\cdot 0{,}6m) \pm \sqrt{9(10^5 Pa + 13600\frac{kg}{m_3}\cdot 10\frac{m}{s^2}\cdot 0{,}6m)^2 - 4\cdot 13600\frac{kg}{m^3}\cdot 10\frac{m}{s^2}\cdot 3\cdot 10^5 Pa\cdot 0{,}6m}}{2\cdot 3\cdot 13600\frac{kg}{m^3}\cdot 10\frac{m}{s^2}} \approx 0{,}12m$$

The answer is: $\Delta l \approx 0{,}12m$

Problem 3. Let the total resistance be *10Ω* when conductors are first connected in sequence; when they are connected in a parallel, it is *1,6Ω*. What resistance do the conductors have?

Let it be:

$R_k=10\Omega$, $R_p=1,6\Omega$

R_1-? R_2-?

Solution: When the conductors are connected in sequence, they have the same current forces like- $I = I_1 = I_2$. Voltages are equal to total amount of the voltages at the ends of conductors- $U = U_1 + U_2$ so, when the conductors are connected in sequence, total resistance is $R_k = R_1 + R_2$.

When the conductors are connected in a parallel way, the voltages of the conductor ends are the same

$$U = U_1 = U_2$$

Current forces are equal to the total amount of current forces of conductor ends

$$I = I_1 + I_2.$$

So, when the conductors are connected in a parallel way, the total resistance is:

$$R_p = \frac{R_1 \cdot R_2}{R_1 + R_2}$$

$$\begin{cases} R_k = R_1 + R_2 = 10\Omega \\ R_p = \dfrac{R_1 \cdot R_2}{R_1 + R_2} = 1{,}6\Omega \end{cases} \Rightarrow \begin{cases} R_k = R_1 + R_2 = 10\Omega \\ R_p = R_1 \cdot R_2 = 16\Omega \end{cases} \Rightarrow R_1^2 - 10R_1 + 16 = 0$$

If we find the roots of equation, it is equal to $R_1 = 2\Omega$, $R_1 = 8\Omega$.

the value is equal to $R_2 = 8\Omega, R_2 = 2\Omega$

The answer is $R_1 = 2\Omega$, $R_2 = 8\Omega$

$R_1 = 8\Omega$ bo‘lsa $R_2 = 2\Omega$

Reference:

1. Mechanics and molecular physics. Book 1. A manual for academic lyceums. M.Ulmasova. Tashkent. 2010.
2. Physics. Electrodynamics. Vibrations and waves. Book 2. A manual for academic lyceums. M.Ulmasova. Tashkent. 2010.
3. Algebra. A textbook for 8^{th} grades. Tashkent. 2006.