CURRENT RESEARCH JOURNAL OF PEDAGOGICS
(ISSN –2767-3278)
VOLUME 04 ISSUE 07 Pages: 12-18
SJIF IMPACT FACTOR (2021: 5. 714) (2022: 6. 013) (2023: 7. 266)
OCLC – 1242041055

Publisher: Master Journals

Journal Website: https://masterjournals.com/index.php/crjp

Research Article

GRAPHICAL SOLUTION OF PHYSICAL PROBLEMS BASED ON DIGITAL TECHNOLOGIES

Submission Date: July 04, 2023, **Accepted Date:** July 09, 2023,
Published Date: July 14, 2023
Crossref doi: https://doi.org/10.37547/pedagogics-crjp-04-07-04

Giyasova Zukhra Rachmatullaevna
Doctoral Student Of The Department Of General Physics National University Of Uzbekistan

ABSTRACT

The article shows that when solving problems in physics, the transition from formulas representing a general solution to particular solutions and the use of a graphical calculator leads to a significant simplification of problem solving.

KEYWORDS

General solution, particular solution, fixed block, inclined planes, graphical method, graphical dependencies, graphical calculator- Desmos.

INTRODUCTION

Solving a problem during the teaching of physics is the most important and complex process of educational activity. In order to master physics well, it is darcur that students first master the methods of solving the problem well. Due to the different difficulty levels of problems in physics and the existence of different ways to solve them, the process of solving a problem for students has always been considered a problematic situation. Because students who have mastered theoretical materials well, Ham sometimes has difficulty choosing ways to solve one or another type of issue. I believe that this is due to the fact that in the physical science program of universities there is not enough time agrotected to the methods of solving the issue.

Methods

From observations in the continuation of my many years of pedogogical activity, it became known that students who, on the basis of theoretical knowledge, solved examples and issues from the Exact Sciences, recognized that only after solving these issues in a graphical way, they had a deeper understanding of the true nature of those rules. Experiments have shown that a significant increase in the quality of education in physics can be achieved by applying digital Tehnologies to solve problems graphically from modern teaching methods to the educational process.

When graphic connections of physical magnitudes are described through drawings the physical phenomenon or processes under the condition of the issue are clearly manifested, the observation of this process or phenomenon is now moving to a more convenient view. By finding the maximum and minimum values of the magnitude, the opportunity arises to determine the sphere of occurrence of the process.

However, when solving a problem with a graph method that requires drawing the graph by readers, they now face another problem. Not always graphics drawn by students are clear, not in demand from aesthetic humor, or mistakes are made when choosing scales. These problems can be overcome by applying graphing calculators based on numerical technologies to problem solving [1]. Solving physical issues in a graphical method based on digital technology, unlike traditional techniques, helps students absorb the large volume of information that is relevant to the subject.

The graphical method of solving problems is also carried out according to a certain algorithm. To solve such issues, it is no longer sufficient to read the condition carefully, but it is also important for the reader to be able to "read the graphs". Here, not only mathematical knowledge that is relevant to students comes to the rescue, but now it is required to think in order to understand the drawings

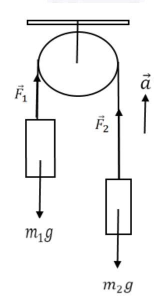
One such calculator is the Desmos Graphing Calculator, which is automatically divided by a calculator with the ability to represent physical processes through graphing links. [2-4] a detailed instruction on the use of a Desmos Graphing Calculator has been developed in the literature.

Results and Discussion

As an example, we describe the [5] graph connections in the following problem using the Desmos calculator.

Issue 1 describes a system in which loads of m_1 and m_2 are suspended, respectively, to the two ends of a thread passed through an excitable block with a mass equal to m, requiring the first body acceleration to be determined by its mass. Where m_1=nm_2, m_2=m. Let the solution of the matter be found first for the total score and then for the private simpler score.

To solve this issue, we use the following expressions of kinematics and dynamics:



1-rasm

- in kinematics, from the link expressions between linear velocity (acceleration) and angular velocity (acceleration, $v = \omega R$
- from the basic equation of the dynamics of progressiveness and circular motion,

$$a = \beta R \quad (1)$$

- or the motion of objects of mass m_1 and m_2, we apply Newton's second law ($\vec{F} = m\vec{a}$), and for the block we apply the Basic Law of circular motion dynamics
- $\vec{M} = I\vec{\beta}$

We believe that when using these expressions, the thread moves along the block without slipping. When the thread moves without slipping, the acceleration of the loads ($\vec{a}$.) is modularly equal to the tangential acceleration of the block edge points. (1) is the angular acceleration of the β block in the expression around the axis of rotation, and R is its radius. $\vec{F}$ is the equal acting moment of all forces acting on the body, $\vec{M}$.is the resultant moment of all forces acting on the block, I is the resultant moment of inertia with respect to its axis of rotation.

$$I = \frac{1}{2}mR^2 = 0{,}5mR^2 \quad (2)$$

Using the above, we can construct dynamic equations of motion for all objects in the system shown in Figure 1.

$$m_1 g - F_1 = m_1 a \quad (3)$$

$$F_2 - m_2 g = m_2 a \quad (4)$$

$$(F_1 - F_2)R = I\beta = \frac{1}{2}mR^2\frac{a}{R} \text{ yoki } (F_1 - F_2) = 0{,}5ma \quad (5)$$

From Equations (2), (4) and (5) we obtain:

$$m_1 g - m_2 g = (m_1 + m_2 + 0{,}5m)a$$

From this equation follows the following equation for the acceleration of loads:

$$a = \frac{(m_1 - m_2)g}{(m_1 + m_2 + 0{,}5m)} \quad (6)$$

If we ignore the mass of the block in this expression, (6) the expression comes to the following appearance (found in some textbooks and test assignments):

$$a = \frac{m_1 - m_2}{m_1 + m_2}g \quad (7)$$

If one considers the relation between masses ($m_1 = nm_2$, $m_2 = m$), the expressions (6) and (7) take the following representations, respectively:

$$a_1 = \frac{(n-1)}{(n+1{,}5)}g \quad (8)$$

$$a_2 = \frac{(n-1)}{(n+1)}g \quad 9)$$

CURRENT RESEARCH JOURNAL OF PEDAGOGICS
(ISSN –2767-3278)
VOLUME 04 ISSUE 07 Pages: 12-18
SJIF IMPACT FACTOR (2021: 5. 714) (2022: 6. 013) (2023: 7. 266)
OCLC – 1242041055
Publisher: Master Journals

Below, using these expressions, we describe the connections between acceleration a and mass ratio n using a Desmos graph calculator.

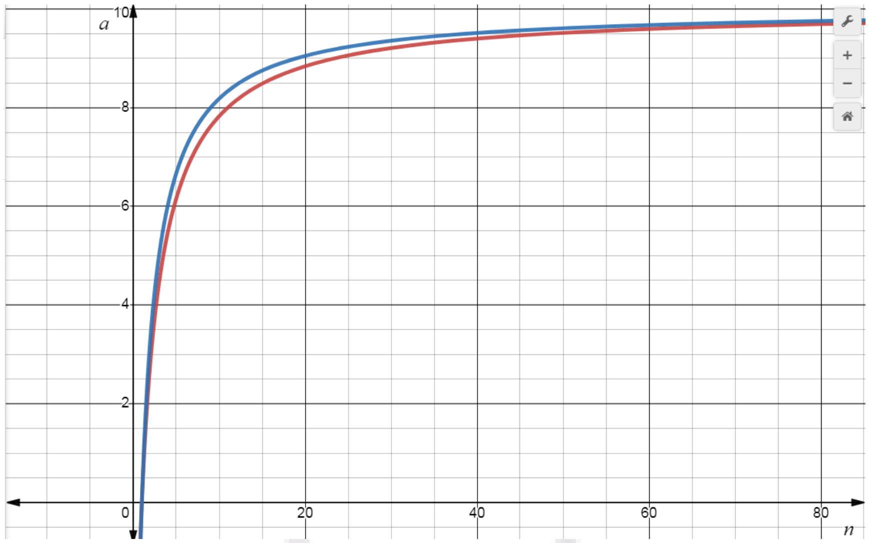


Fig. 2

The graph shows that at small values of n, the difference between a_1 and a_2becomes noticeable, while at large values of n, they are almost the same as the free-fall acceleration tends to g, but does not exceed it. This makes it clear that the acceleration of objects of mass $m_1 = nm_2, m_2 = m$ in the graphic block is always a<g

In addition, using the Desmos Graphing Calculator, one can also obtain graphical links that represent the dynamics of change of forces F_1 and F_2depending on the masses m_1 and m_2..

There are various ways to solve a problem [1-2], one of which is a way to move from a general solution to a private solution to a problem

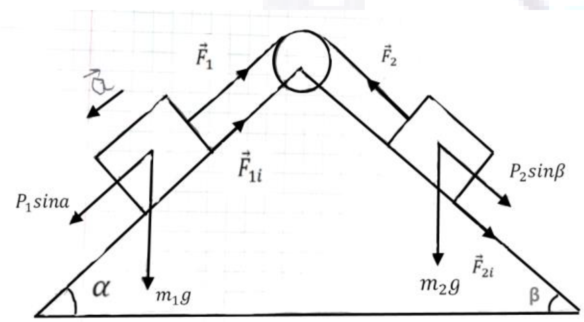


Fig.3

Issue 2. Figure 3 shows sloping planes with slope angles $\alpha = 60^0$ and $\beta = 30^0$, with a block at the highest point of their union equal to M in mass and able to rotate freely around the non-excitable axis. A non-stretchable thread is wrapped evenly into the block, to the ends of which are connected brusocks of mass m_1 and m_2 ($m_1 \geq m_2$), located

CURRENT RESEARCH JOURNAL OF PEDAGOGICS
(ISSN –2767-3278)
VOLUME 04 ISSUE 07 Pages: 12-18
SJIF IMPACT FACTOR (2021: 5.714) (2022: 6.013) (2023: 7.266)
OCLC – 1242041055
Publisher: Master Journals

in a sloping plane. If the friction coefficients between the brusocks and the inclined planes are equal to $k_1 = k_2 = 0{,}1$, then how do these brusocks move with acceleration? How does their acceleration change with the change in the mass of the first brusok? For simplicity, let $m_1 = nm_2, m_2 = m$. Let the solution of the issue be addressed first in the general case, and then in the private case.

Given: $m_1 = nm_2 = nm, \alpha = 60^0$, $\beta = 30^0$, $k = k_1 = k_2 = 0{,}1$

Need to find: $a = a(m_1)$

To solve this issue:

1) in kinematics, we use the link expression between linear acceleration and angular acceleration from $a = \beta R$ and 2) the Basic Laws of the dynamics of progressiveness and circular motion from $\vec{F} = m\vec{a}$ and $\vec{M} = I\vec{\beta}$. Is the moment of inertia with respect to the axis of rotation of Block I in the final formula (($I = 0{,}5mR^2$

In Plot 1, $F_{1i} = k_1 m_1 g cos\alpha$ and $F_{2i} = k_2 m_2 g cos\beta$ are frictional forces occurring between the first and second brusocks, respectively; while $m_1 g sin\alpha$ and $m_2 g sin\beta$ are oblique planes forming parallel to the planes of the gravity acting on the first and second body, respectively; F_1 and F_2 are forces acting on the brusocks by ip.

Now let's write down the dynamic equations of motion for two brusocks and a block:

$$m_1 g sin\alpha - F_1 - k m_1 g cos\alpha = m_1 a\,, \qquad (1)$$

$$F_2 - m_2 g sin\beta - k m_2 g cos\beta = m_2 a\,, \qquad (2)$$

$$(F_1 - F_2)R = I\beta = \frac{1}{2} mR^2 \frac{a}{R} \text{ yoki } (F_1 - F_2) = 0{,}5ma\,. \qquad (3)$$

Using these equations, we obtain the following expression for the acceleration of brusocks

$$a = \frac{[m_1(sin\alpha - kcos\alpha) - m_2(sin\beta + kcos\beta)]}{m_1 + m_2 + 0{,}5m}\, g\,. \qquad (4)$$

Those are now a number of private points to consider.

1) if the friction forces are ignored in the matter (4) the equation comes to the following view

$$a = \frac{m_1 sin\alpha - m_2 sin\beta}{m_1 + m_2 + 0{,}5m}\, g \qquad (5)$$

2) If the problem condition takes k=0 and m=0, the expression (4) takes the following view

$$a = \frac{m_1 sin\alpha - m_2 sin\beta}{m_1 + m_2}\, g \qquad (6)$$

3) If, under the condition of the matter, the expression $\alpha = \beta = 90^0$ (6) represents the motion of bodies hanging on an excitable block:

$$a = \frac{(m_1 - m_2)g}{m_1 + m_2 + 0{,}5m} \qquad (7)$$

CURRENT RESEARCH JOURNAL OF PEDAGOGICS
(ISSN –2767-3278)
VOLUME 04 ISSUE 07 Pages: 12-18
SJIF IMPACT FACTOR (2021: 5. 714) (2022: 6. 013) (2023: 7. 266)
OCLC – 1242041055
Publisher: Master Journals

4) (7) if the block in the expression is considered weightless, then the acceleration of the body takes the view,

$$a = \frac{m_1 - m_2}{m_1 + m_2} g \qquad (8)$$

5) If the problem condition takes $\alpha = \beta = 90^0$, $m_2 = 0$ (5) the equation reflects the acceleration of an object suspended at the tip of a thread wrapped in an excitable block:

$$a = \frac{m_1 g}{m_1 + 0{,}5m} \qquad (9)$$

Considering those given under the condition of the matter (5),(6),(7),(8),(9) the equations take the following views.

$$a = \frac{[n(sin\alpha - kcos\alpha) - (sin\beta + kcos\beta)]}{n+1{,}5} g \qquad (4^/)$$

$$a = \frac{(n \cdot sin\alpha - sin\beta)g}{n+1{,}5} \qquad (5^/)$$

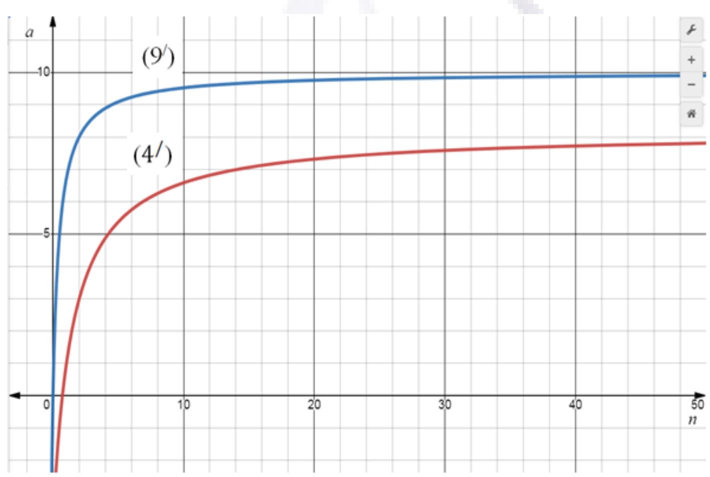
$$a = \frac{(n \cdot sin\alpha - sin\beta)g}{n+1} \qquad (6^/)$$

$$a = \frac{(n-1)g}{n+1{,}5} \qquad (7^/)$$

$$a = \frac{(n-1)g}{n+1} \qquad (8^/)$$

$$a = \frac{n \cdot g}{n+0{,}5} \qquad (9^/)$$

In addition to the above, it is possible to realize the forces of elasticity that occur in the cross-linking thread of bodies, their dependence on their masses, using a Desmos Graphing Calculator. Using the Desmos Graphing Calculator, we draw $a(m_1)$ links for $(4^/)$ and$(9^/)$



CONCLUSION

Thus, while the use of the graph method in practical training makes it easier for students to better understand the physical phenomenon described in the matter condition, the use of the Desmos calculator in solving such issues serves to overcome several difficulties in solving the graph problems. At the end of the article, it should be noted that graph connections described using a Desmos graph calculator increase the informativity of the problem solution.

REFERENCES

1. Giyasova Z.R. Zakhidova M.A. The use of a Desmos graph calculator in solving a problem in the graph method from physics. TDPU scientific information. Issue 6, 2022. 262-267 .
2. Postroenie grafikov functional s pomotshyu graficheskoy system
7.

desmos.com/calculator.razum.ru/publ/postroenie_grafikov_funkcij_s_pomoshhju_graficheskoj_sistemy_desmos_com/1-1-0-20
3. Rabotaem V Desmos. https://kak-reshit-zadachu.schoolpsiholog.ru/2015/03/desmos.html?m=1
4. M.S. Ladnix. Graphicheskie method reshenia zadach po fizike. Maou "Obrazovatelny complex " algorithm Uspexa", 2019
5. V.V.Bogun. Ispolzovanie graficheskogo calculatora v obuchenii matematike Kak sredstvo povisheniya urovnya prakticheskogo mishleniya studentov vuzov. Vestnik RUDN, serial Informatization obrazovaniya, 2013, № 2
6. Zakhidova M.A., Abdullayev R.M., Begmatova D.A., Giyasova Z.R. Methods of solving problems from physics. Tutorial. Tashkent, "Innovation-Ziyo", 2022.