

Optimising Maths Courses with Möbius



DigitalEd

About DigitalEd...



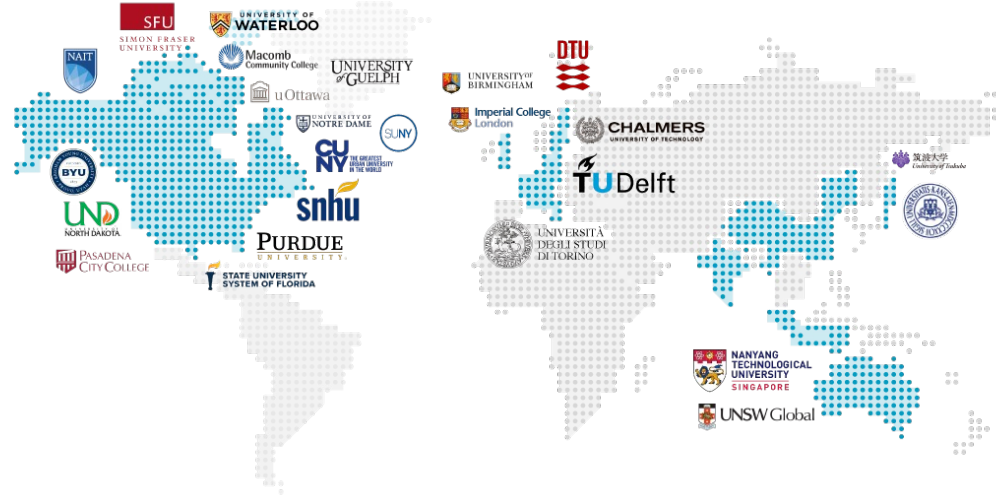
300+ schools



440,000+ class enrollments



>17,000,000 automatically graded assessments



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möbius



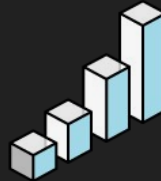
Möbius brings complex STEM disciplines to life with its **world-class math-engine**.



Give students **immediate and meaningful feedback** and provide instructors with data on student engagement and understanding.



Access to **high-quality content** created by curriculum experts to let you get up and running quickly.



Create and use **powerful multimedia visualizations** to anchor key STEM concepts.



Go beyond simple question types with automatically marked, algorithmically generated randomized questions.



Seamlessly integrate Möbius with your Learning Management System (LMS).

DigitalEd

Platform Bundled with Content

Fully immersive, digital courseware with dynamic content and instant feedback, yields impressive, measurable improvements in student learning outcomes.

Content Starter Packs for core STEM topics are included with the platform and can be customized by the customer

DigitalEd Content Starter Packs quickly demonstrate the power of the Möbius platform, and shortens both our sales cycle and speed of adoption to all STEM departments, increasing our total market share / revenue.

- DEVELOPMENTAL MATH & PROBLEM SOLVING
- PRECALCULUS & CALCULUS
- CALCULUS I & II FOR SCIENCE
- DIFFERENTIAL EQUATIONS
- LINEAR ALGEBRA
- COLLEGE ALGEBRA
- COLLEGE PHYSICS
- MECHANICS, WAVES & ACOUSTICS
- PROBABILITY & STATISTICS
- FINANCIAL MATH
- HIGH SCHOOL MATH
- ETC.

Math Question Types

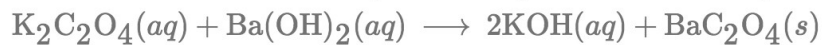
- > 50 Math Question Types
- Math Expressions & Formulas
- Math Equations, Systems of Equations
- Math Applications (Interactive)
- Math Graded, Open / Free-form Response
- Numeric, Units, Tolerances
- Trigonometry, Logarithms, Exponentials
- Differential Equations: Solutions + Unevaluated
- Integrals: Definite / Indefinite + Unevaluated
- Matrix and Vector Operations
- Sets and Lists
- Plotting and Sketching
- Free Body Diagrams
- Chemical Equations
- Adaptive Questions
- HTML 5

General Math Functionality

- General Functionality in all question types (hints, randomization, feedback, etc.)
- Mathematical Equivalence
- Open Response Questions
- Equation Editor & Typeset Math
- Randomization, Constraints
- All Mathematical Constructs
 - Sets, Sequences, Series, Vectors, Matrices, Vector Fields, Tensors, Statistical Distributions, etc.
- Interactive 2D/3D Visualization and Plots

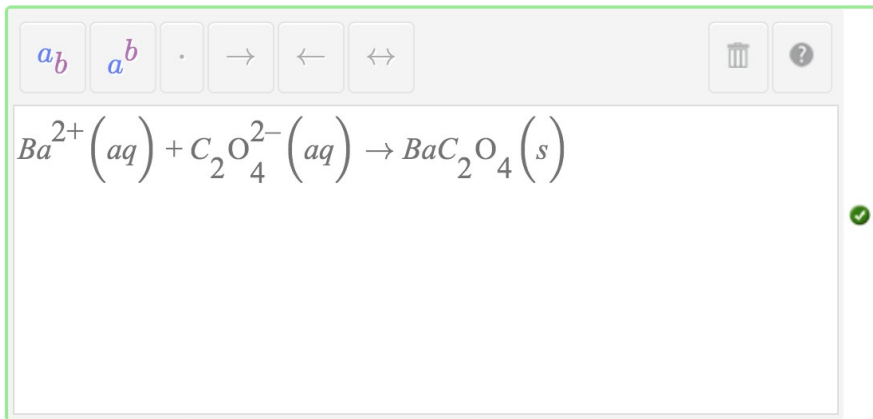
Math Expressions & Formulas

From the balanced molecular equation below, write the net ionic equations.



Include physical states.

The net ionic equation is:



Find the period and horizontal shift of $f(x) = 4 \tan(5x - 35)$.

Enter the exact answers.

a^b $\frac{a}{b}$ \sqrt{a} $|a|$ π $\sin(a)$



$\frac{\pi}{5}$


Period: $P =$

Find the partial fraction expansion.

$$\frac{x^3 - 4x^2 + 6x + 2}{(x-2)^3}$$

Leave denominators of the partial fraction decomposition in factored form.

a^b $\sin(a)$ ∞ α  

$$\frac{2}{x-2} + \frac{2}{(x-2)^2} + \frac{6}{(x-2)^3} + 1$$


Math Equations and Systems of Equations

Find the general solutions of:

$$\frac{dy}{dx} - 6xy = 6x$$

Calculator interface showing the input $y = (-1) + Ce^{3x^2}$. The interface includes a toolbar with mathematical symbols: a^b , $\frac{a}{b}$, \sqrt{a} , $|a|$, π , $\sin(a)$, a trash icon, and a help icon. A green checkmark is visible on the right side of the input area.

This question accepts equations. E.g. $y-2 = 5(x-4)+1$.

[Help](#) | [Switch to Text Entry](#)

Solve the system of equations by Gaussian elimination.

$$2x - y + 3z = 12 \quad (1)$$

$$-5x + 4y - 2z = -32 \quad (2)$$

$$2y + 5z = -5 \quad (3)$$

Enter the exact answer as an ordered triple, (x, y, z) .

If there is no solution, enter NS. If there is an infinite number of solutions, enter IS.

Math App and Interactive Questions

Follow the instructions, using different functions f , values of c , ϵ and δ to observe graphically why the proof works.

1. Choose a function: Linear

2. Choose a value for c :

$c =$

3. Ask for an ϵ : Give me a new epsilon!

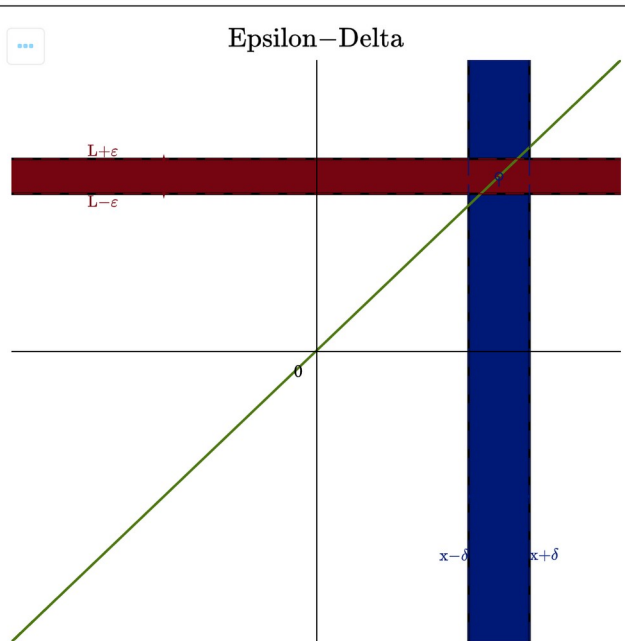
$\epsilon =$.6

4. Try to choose δ small enough so that $|x - c| < \delta$ implies $|f(x) - L| < \epsilon$. T. If the blue strip is a river, and the purple strip is a bridge, then the function (green) must only cross the river where the bridge is!

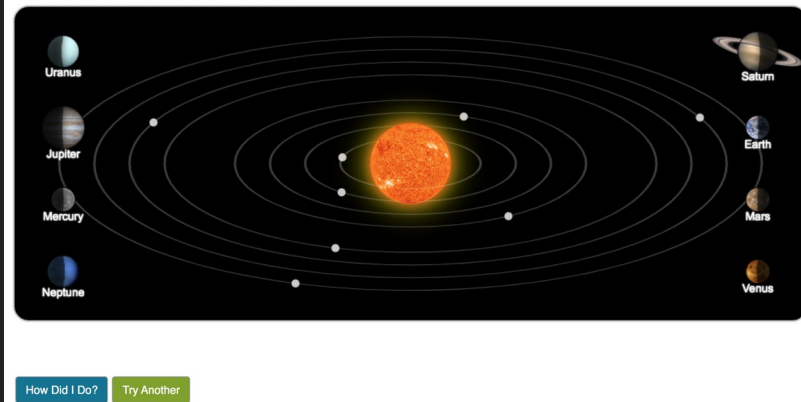
$\delta =$

5. If it's not possible to choose such a δ , the function $f(x)$ does not have a limit at the point c !

Shade Region

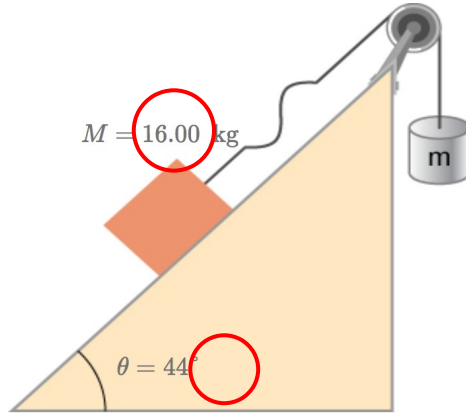


Drag and drop each planet into the correct orbit around the sun.



Algorithmic Randomization

Consider what is shown below. A mass M rests on a frictionless ramp inclined at 44° . A string with a linear mass density of $\mu = 0.015 \text{ kg/m}$ is attached to mass M . The string passes over a frictionless pulley of negligible mass and is attached to a hanging mass (m). The system is in static equilibrium. A wave is induced on the string and travels up the ramp.



Round your answers to two significant figures.

(a) What is the mass of the hanging mass (m)?

Mass of the hanging mass is kg.

(b) At what wave speed does the wave travel up the string?

The wave travels up the string with a speed of m/s.

How Did I Do?

Try Another

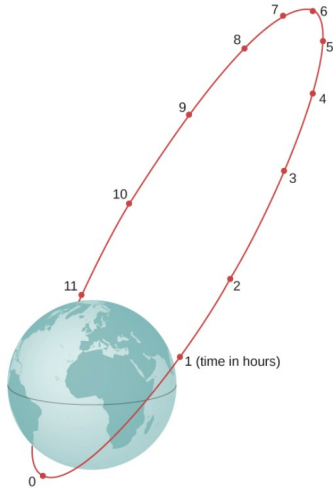


Algorithm generates
a new set of values
for variables...

in the question text,
diagram and in the
fully worked out
solution

Numeric Questions: Units, Tolerance

A Molniya orbit is a highly eccentric orbit of a communication satellite so as to provide continuous communications coverage for Scandinavian countries and adjacent Russia. The orbit is positioned so that these countries have the satellite in view for extended periods in time (see below). If a satellite in such an orbit has an apogee at 44,000 km as measured from the center of Earth and a velocity of 3.5 km/s, what would be its velocity at perigee measured at 195 km altitude?



Round your answer to two significant figures.

Molniya's velocity at perigee would be .

How Did I Do?

Try Another

Numeric

Weighting

1

Numeric Part

\$perigeevelocity

Units Part:

km/s

Numeric Format: Accept 1000s separator

Accept scientific notation

Accept \$ sign

Accept arithmetic

-1,234.0; -1.234E+3 or (1,234.0; 1.234E+3)

-1,234.0; -1.234E+3

(1,234.0; 1.234E+3)

Required with:

Margin of error

Margin of Error

1.0

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Trigonometry, Logarithms and Exponentials

A Ferris wheel is 24 meters in diameter and boarded from a platform that is 1 meter above the ground. The six o'clock position on the Ferris wheel is level with the loading platform. The wheel completes 1 full revolution in 8 minutes. The function $h(t)$ gives a person's height in meters above the ground t minutes after the wheel begins to turn.

a. Find the amplitude, midline, and period of $h(t)$.

Enter the exact answers.

Amplitude: $A =$ m

Midline: $h =$ m

Period: $P =$ minutes

b. Find a formula for the height function $h(t)$.

Enclose arguments of functions in parentheses. For example, $\sin(2x)$.

$h(t) =$



Solve the following equation for x . Enter an exact answer.

$$8 \ln(x) - \ln(x^2) = 1$$

$x =$

Rewrite the following logarithm in terms of the natural log (base e)

$$\log_2 10$$

$\frac{\ln(10)}{\ln(2)}$

Integrals

Evaluate the following indefinite integral:

$$\int \frac{1}{36+x^2} dx$$

$$\left(\frac{1}{6}\right) \arctan\left(\frac{1}{6}x\right) + C$$

Evaluate

$$\int_0^1 \int_0^{\sqrt{1-x^2}} \int_0^{\sqrt{2-x^2-y^2}} \frac{1}{\sqrt{x^2+y^2}} dz dy dx$$

$$\pi \cdot \frac{\sqrt{2}-1}{3}$$

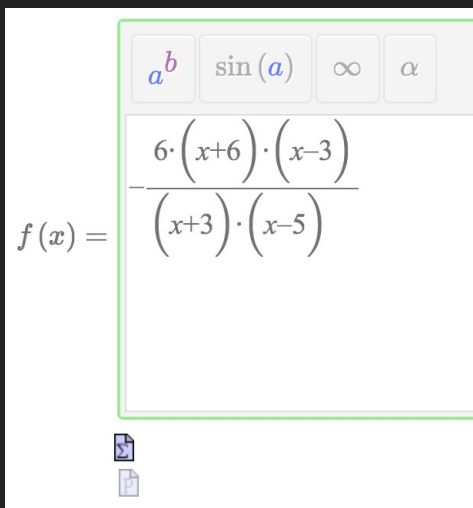
Mathematical Equivalence

Write an equation for a rational function with the given characteristics.

Vertical asymptotes at $x = -3$ and $x = 5$, x -intercepts at $(-6, 0)$ and $(3, 0)$, horizontal asymptote at $y = -6$

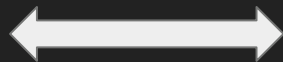
Enclose numerators and denominators in parentheses. For example, $(a - b) / (1 + n)$.

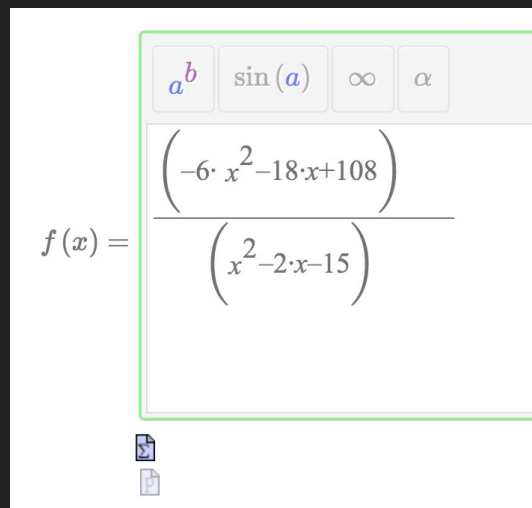
Include a multiplication sign between symbols. For example, $a * x$.



A screenshot of a digital math input interface. At the top, there are buttons for mathematical symbols: a^b , $\sin(a)$, ∞ , and α . Below these buttons, the equation $f(x) = \frac{6 \cdot (x+6) \cdot (x-3)}{(x+3) \cdot (x-5)}$ is entered. The interface includes a small document icon at the bottom left and a larger document icon at the bottom right.

Both simplified
and expanded
forms get
marked 'Correct'





A screenshot of a digital math input interface, identical to the one on the left. It shows the same rational function, but in expanded form: $f(x) = \frac{(-6 \cdot x^2 - 18 \cdot x + 108)}{(x^2 - 2 \cdot x - 15)}$. The interface includes the same symbol buttons at the top and document icons at the bottom.

Open Response Math Questions

Provide an equation of any line that passes through the point $(x, y) = (3, 6)$.

Calculator interface showing the equation $\frac{5}{2}x - y - \frac{3}{2} = 0$ entered in the input field. The toolbar includes buttons for a^b , $\sin(a)$, $\frac{\partial}{\partial x} f$, a grid, ∞ , α , Ω , a trash icon, and a help icon. A green checkmark is visible on the right side of the input field.

Calculator interface showing the equation $y - 2x = 0$ entered in the input field. The toolbar includes buttons for a^b , $\sin(a)$, $\frac{\partial}{\partial x} f$, a grid, ∞ , α , Ω , a trash icon, and a help icon. A green checkmark is visible on the right side of the input field.

Other Mathematical Constructs

Express all real numbers less than -4 or greater than or equal to 6 in interval notation.

To enter ∞ , type *infinity*. To enter \cup , type *U*.



The sets A and B are given below.

$$A = \{2, 4, 5, 6, 10, 12, 14, 15, 16\}$$

$$B = \{3, 6, 10, 11, 12, 13, 16, 18, 20\}$$

Find $A \cap B$



mark of

Differential Equations

Use the convolution theorem to find the inverse Laplace transforms.

Note: Write exponentials e^{at} as " $e^{(a*t)}$ ".

$$(i) G(s) = \frac{1}{(s+3)^2(s+2)} \Rightarrow \mathcal{L}^{-1}[G(s)] = g(t) = e^{(-2*t)-(t+1)*e^{(-3*t)}}$$

Laplace Transforms

$f(t)$	$\mathcal{L}\{f(t)\} = F(s)$
1	$\frac{1}{s}$
t^n	$\frac{n!}{s^{n+1}}$
e^{at}	$\frac{1}{s-a}$
$\sin kt$	$\frac{k}{s^2+k^2}$
$\cos kt$	$\frac{s}{s^2+k^2}$
$f'(t)$	$sF(s) - f(0)$
$e^{at}f(t)$	$F(s-a)$ (First Shift Theorem)
$f(t-a)H(t-a)$	$e^{-as}F(s)$ (Second Shift Theorem)

a. Find the solution of the initial value problem

$$y'' - y' - 6y = 0, \quad y(0) = 2, \quad y'(0) = 2$$

$$y = 4 \frac{e^{(-2)t}}{5} + \frac{6}{5} e^{3t}$$

Matrix & Vector Operations

Use the matrices below to perform matrix multiplication.

$$C = \begin{bmatrix} 4 & 10 \\ -3 & 6 \\ 5 & 9 \end{bmatrix}, D = \begin{bmatrix} 3 & -4 & 11 \\ 8 & 4 & 1 \\ 0 & 7 & -11 \end{bmatrix}$$

If the operation is undefined, enter NA.

$DC =$

$$\begin{bmatrix} 79 & 105 \\ 25 & 113 \\ -76 & -57 \end{bmatrix}$$

Use the cross product to find a **non-zero** vector orthogonal (perpendicular) to the following pair of vectors: $(-6, -4, -2)$ and $(-3, -6, -2)$

Enter the vector entries separated by commas, e.g. 1, 3,-1 (notice that brackets are provided). Be sure to check your answer using the dot product.

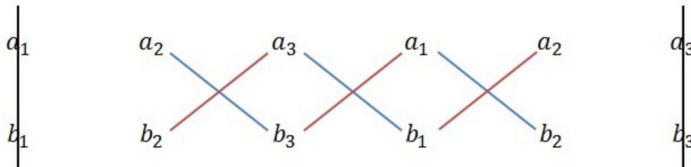
(✓  )

Feedback

Given general vectors $\vec{a} = (a_1, a_2, a_3)$ and $\vec{b} = (b_1, b_2, b_3)$, the cross product is calculated as follows:

$$\vec{a} \times \vec{b} = (a_1, a_2, a_3) \times (b_1, b_2, b_3) = (a_2b_3 - a_3b_2, a_3b_1 - a_1b_3, a_1b_2 - a_2b_1)$$

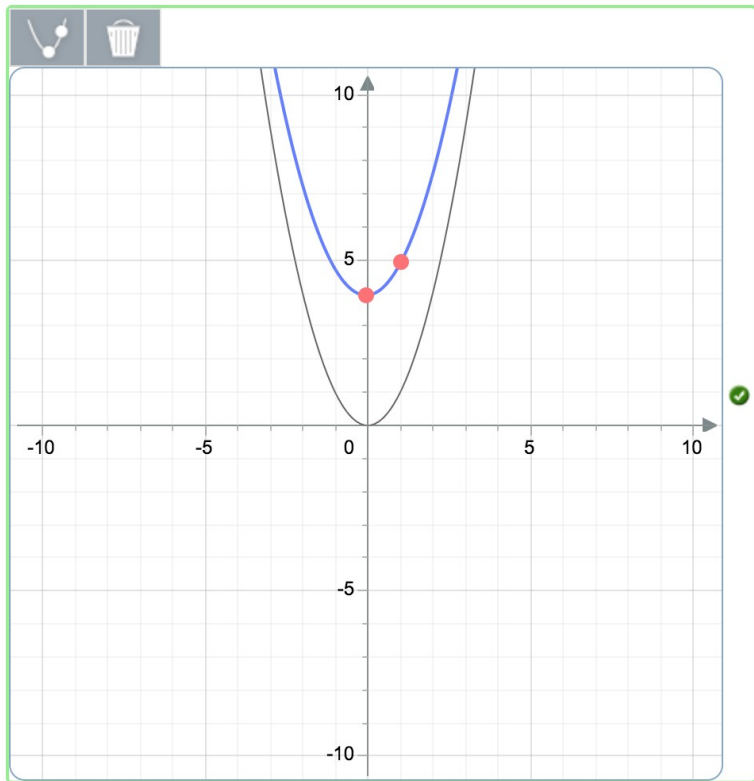
A trick to remember the cross-product formula is to use the following diagram. Setting it up is as simple as writing the components of each vector twice in two horizontal rows. We then ignore the far left and far right columns and draw diagonal lines between the components. Each pair of diagonals (forming an X) represents a component of the cross product.



Try Another

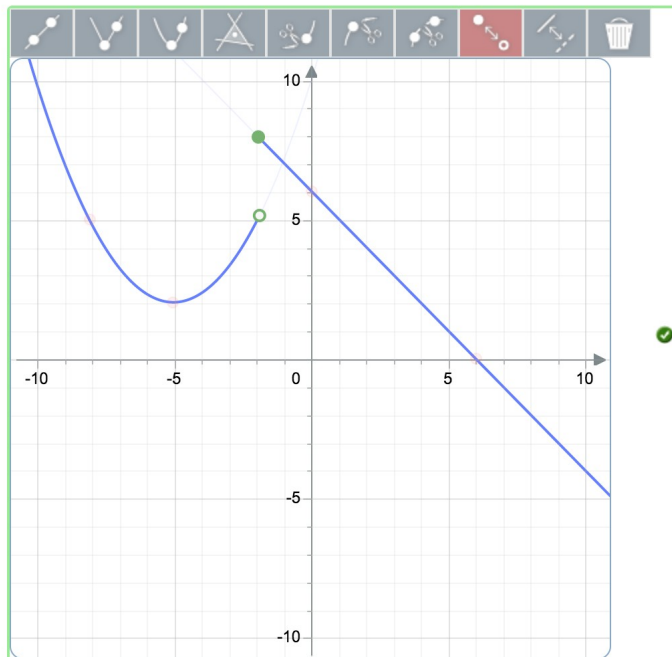
Plots: Sketching Question Type

The following sketch shows the equation $y = x^2$. Please sketch $y = x^2 + 4$



Sketch the following piecewise function.

$$f(x) = \begin{cases} \frac{(x+5)^2}{3} + 2 & x < -2 \\ 6 - x & x \geq -2 \end{cases}$$

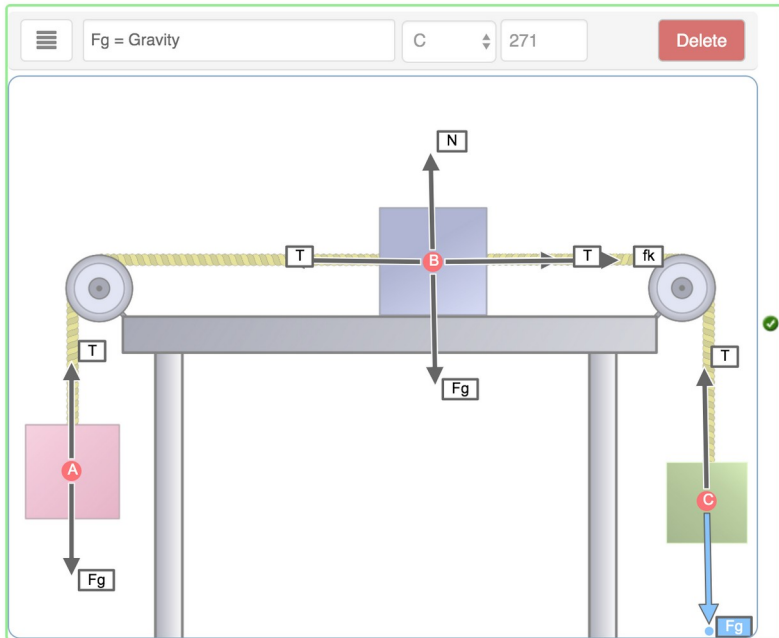


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Free Body Diagrams

Three boxes are attached by ropes that pass over a pair of massless, frictionless pulleys. The coefficient of kinetic friction between the middle box and the table is μ . Draw a free body diagram for each box if the system moves at a constant speed from right to left

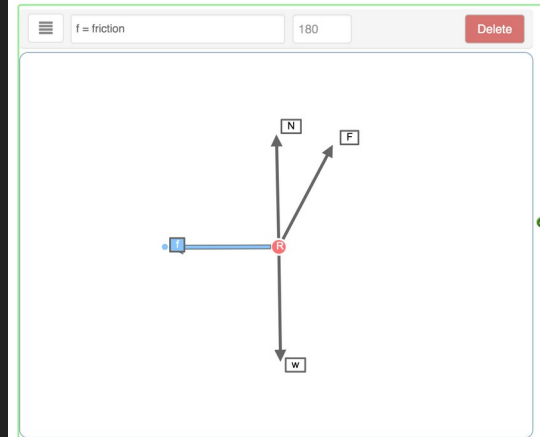
Start drawing forces by clicking on a starting point and dragging your cursor to the desired area or make a selection below and click the add button.



A runner pushes against the track, as shown.

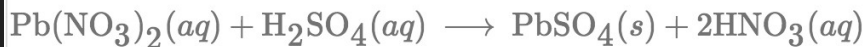


Provide a free-body diagram showing all the forces on the runner. Where the direction of \vec{F} is 60° from the vertical. (Hint: Place all forces at the center of his body, and include his weight.)



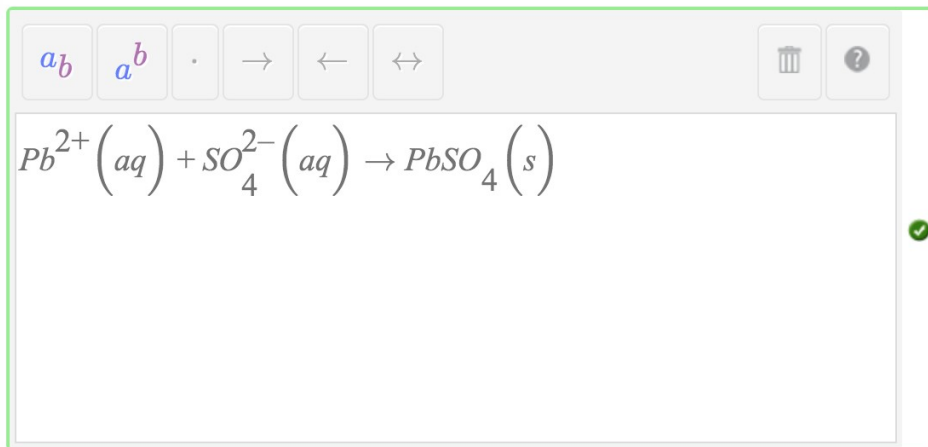
Chemical Formulas & Equations

From the balanced molecular equation below, write the net ionic equation.



Please include physical states in brackets following chemical formulas.

The net ionic equation is:



Correct

Your Answer: $\text{Pb}^{2+}(\text{aq}) + \text{SO}_4^{2-}(\text{aq}) \rightarrow \text{PbSO}_4(\text{s})$

Correct Answer: $\text{Pb}^{(2+)}(\text{aq}) + \text{SO}_4^{(2-)}(\text{aq}) \rightarrow \text{PbSO}_4(\text{s})$



Equation Editor & Palettes

The main interface shows a toolbar with buttons for a^b , $\sin(a)$, $\frac{\partial}{\partial x} f$, a grid icon, ∞ , α , and Ω . A palette for Greek letters is open, displaying a grid of symbols: $\alpha, \beta, \gamma, \delta, \epsilon$; $\zeta, \eta, \theta, \iota, \kappa$; $\lambda, \mu, \nu, \xi, \omicron$; $\pi, \rho, \sigma, \tau, \upsilon$; $\varphi, \chi, \psi, \omega$.

Find the solution of the initial value problem

$$y'' - y' - 6y = 0, \quad y(0) = 2, \quad y'(0) = 2$$

$y =$

A row of symbols from the editor palette: a^b , $\frac{a}{b}$, \sqrt{a} , $|a|$, π , and $\sin(a)$.

$$\frac{6}{5}e^{3t} + \frac{4}{5}e^{-2t}$$

A palette showing differentiation and integration symbols: $\frac{d}{dx}$, $\int f dx$, and $\int_a^b f dx$.

A palette for matrix and table creation. It includes icons for a vertical ellipsis, a horizontal ellipsis, a rectangular grid, and a square grid. Below these is a section for "Rows" and "Columns" with input fields containing "1" and "1", and an "Insert" button.

A palette for radicals and fractions: \cup , $\frac{a}{b}$, a^b , a_b , a^c_b , \sqrt{a} , $\sqrt[n]{a}$, and $|a|$.

A palette for trigonometric functions: $\sin(a)$, $\frac{\partial}{\partial x} f$, a grid icon, ∞ , α , and Ω . Below this is a section for trigonometric functions: $\sin(a)$, $\cos(a)$, $\tan(a)$; $\sec(a)$, $\csc(a)$, $\cot(a)$; $\sin^{-1}(a)$, $\cos^{-1}(a)$, $\tan^{-1}(a)$.

Adaptive Questions

Find the 13th term of the sequence 2, 5, 8, 11, ...

Number

Section Attempt 1 of 1

Verify

Start Over

Number Help



Find the 13th term of the sequence 2, 5, 8, 11, ...

22 ✖

Identify the common difference, $d =$

Identify the first term, $a_1 =$

Section Attempt 1 of 1

Verify

Start Over

Number Help



Find the 13th term of the sequence 2, 5, 8, 11, ...

22 ✖

✓

Identify the common difference, $d =$ ✓

Identify the first term, $a_1 =$ ✓

Determine the expression for the nth term, $a_n =$

\pm \neq π $\frac{a}{b}$ $|a|$ a^b a_b \sqrt{a} $\sqrt[n]{a}$ trash $?$

Back



Find the 13th term of the sequence 2, 5, 8, 11, ...

22 ✖

✓

Identify the common difference, $d =$ ✓

Identify the first term, $a_1 =$ ✓

✓

Determine the expression for the nth term, $a_n = 3 \cdot n - 1$ ✓

Determine the 13th term, $a_{13} =$ ✓

Start Over

Number Help

Thank-you



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