KHANACADEMY

CollegeBoard SAT®

Official SAT Practice

Lesson Plans

for Teachers by Teachers

LESSON 14 (4 OF 4 FOR PASSPORT TO ADVANCED MATH)

Analyzing More Complex Equations in Context

Subscore: Passport to Advanced Math

Focus: Analyzing more complex equations in context

Objectives:

Students will

- use an equation describing a context to determine how a change in one quantity affects another quantity.
- manipulate equations to isolate a quantity of interest on one side of the equation.
- produce or identify a form of an equation that reveals new information about the context it represents or about the graphical representation of the equation.

Before the Lesson:

- ☐ Review the Teacher Notes.
- ☐ Make sure students have access to Official SAT® Practice during class if completing the main activity.
- ☐ Make sure you have a way to share the example problems with students if completing the alternate activity.

Partner Work | 40 minutes

- Have students complete the Basic and Harder Examples for "Interpreting nonlinear expressions," and "Isolating quantities," in Official SAT Practice on Khan Academy®.
  - Remind students to pause the video as soon as they can see the problem. Once students have worked through the problem, have them watch the video to check their work.

Teacher Notes

- The videos from these two sections add up to about 14 minutes. Encourage students to discuss their solutions and questions for each problem prior to watching the video.

Alternative Activity: Classwork and Discussion (as time allows)

Have students complete the Example Problems below and then discuss them in small groups or as a class. Review terms and definitions, as needed (see Teacher Notes below).

1. If an object of mass m is moving at speed v, the object's kinetic energy KE is given by the equation $KE = 1/2mv^2$. If the mass of the object is halved and its speed is doubled, how does the kinetic energy change?
   - **A.** The kinetic energy is halved.
   - **B.** The kinetic energy is unchanged.
   - **C.** The kinetic energy is doubled.
   - **D.** The kinetic energy is quadrupled (multiplied by a factor of 4).

2. A gas in a container will escape through holes of microscopic size, as long as the holes are larger than the gas molecules. This process is called effusion. If a gas of molar mass M_1 effuses at a rate of r_1 and a gas of molar mass M_2 effuses at a rate of r_2, then the following relationship holds.

$$\frac{r_1}{r_2} = \sqrt{\frac{M_2}{M_1}}$$

This is known as Graham's law. Which of the following correctly expresses M_2 in terms of M_1, r_1, and r_2?

A) $M_2 = M_1\left(\frac{r_1^2}{r_2^2}\right)$

B) $M_2 = M_1\left(\frac{r_2^2}{r_1^2}\right)$

C) $M_2 = \sqrt{M_1}\left(\frac{r_1}{r_2}\right)$

D) $M_2 = \sqrt{M_1}\left(\frac{r_2}{r_1}\right)$

3. A store manager estimates that if a video game is sold at a price of p dollars, the store will have weekly revenue, in dollars, of $r(p) = -4p^2 + 200p$ from the sale of the video game. Which of the following equivalent forms of $r(p)$ shows, as constants or coefficients, the maximum possible weekly revenue and the price that results in the maximum revenue?
   - **A.** $r(p) = 200p - 4p^2$
   - **B.** $r(p) = -2(2p^2 - 100p)$
   - **C.** $r(p) = -4(p^2 - 50p)$
   - **D.** $r(p) = -4(p - 25)2 + 2{,}500$

Teacher Notes

- See Examples 17–19 pages 238–239 in Chapter 18 of the *SAT Study Guide for Students* for answers and explanations.
- Remind students to always start by identifying exactly what the question asks. In Example Problem 2, students are being asked to isolate the variable $M2$. Squaring both sides of the equation is a great first step as it allows you to eliminate the radical sign.
- In Example 3, the fact that the coefficient of the squared term is negative for this function indicates that the graph of r in the coordinate plane is a parabola that opens downward. Thus, the maximum value of revenue corresponds to the vertex of the parabola.

Homework | 20 minutes

- Complete practice problems in Official SAT Practice on Khan Academy in these skill areas:
  - Interpreting nonlinear expressions
  - Isolating quantities
- Encourage students to move on to the higher skill level once they complete the problems in their current skill level and can "level up."