Problem Solving Using CME & Core-Plus

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Guess-Check-Generalize

- Take a guess about the answer.
- Check your guess.
- Make your guess a variable and follow the same steps you used to check your guess.
- Write the equation.

Extensible

Problem 1

Last summer, Katie mowed lawns to earn money. She mowed 35 lawns per week and charged $6 per lawn. This summer, Katie wants to earn an additional $150 per week. She will raise her price to $8 and find more customers. How many new customers will she need to find?

Problem 2

Tony has a $100 gift certificate at a music store Web site. The store offers a 15% discount off the retail price of CDs. It also charges $12 for shipping an order. If Tony wants to spend exactly $100 including the discount and shipping cost, what is the greatest total retail price he can afford?

Summary

- Habits of Mind
- Extensible Strategies
- Student Performance

Features of Core-Plus

- Integrated Content
- Active Learning
- Mathematical Modeling
- Multiple Representations

What Makes It Different?

- Emphasizes functions as a means of understanding algebraic concepts.
- Turns the traditional way of learning “upside-down” and “backwards”.
- Allows students to gain meaning from mathematics by solving problems and developing the skills to go along with it.

Consider This Scenario

Suppose a pumpkin is fired upward from the barrel of a compressed-air cannon at a point 20 feet above the ground at an initial upward velocity of 90 feet per second (about 60 miles per hour).

What are the questions that would typically be asked of students?

Possible Questions

- When will the pumpkin hit the ground?
- At what time will the pumpkin be 30 feet off of the ground?
- What is the maximum height of the pumpkin?
- Write a quadratic equation to model the situation.

Our Agenda

Today we will look at how Core-Plus uses students understanding of functions to develop the model

$$h(t) = h_0 + v_0 t - 16t^2$$

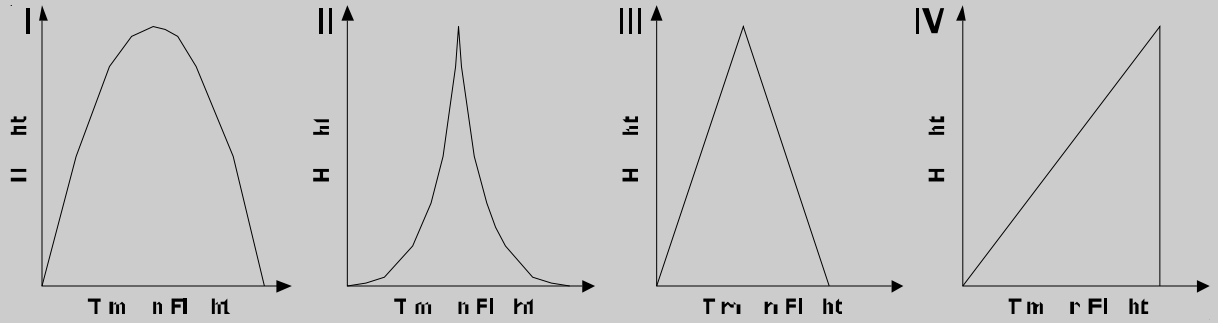
and in turn be able to build a general quadratic rule for the height (in feet) of a projectile over time (in seconds).

A Typical Lesson Opener

Think About This Situation

The current distance record for PunkinÕChunkinÕis over 4,000 feet. Such a flight would take the pumpkin very high in the air, as well.

8. Which of these graphs is most likely to fit the pattern relating pumpkin height to time in flight? Explain your choice.



9. What pattern would you expect to find in data tables relating pumpkin height to elapsed time?

How would you answer this question if you were a student?

Development of Lesson

Step 1: Dropping a pumpkin from a given height

ex: $h(t) = 100-16t^2$

Step 2: Firing a pumpkin straight upwards with a given initial velocity

ex: $h(t) = 20 + 90t$

Step 3: Putting it all together in terms of the combination of 3 factors – initial height, initial upward velocity, and gravity

ex: $h(t) = 20+90t-16t^2$

Step 4: Applying results

Checkpoint

Summarize the Mathematics

In this investigation, you used several strategies to find rules for quadratic functions that relate the position of flying objects to time in flight. You used those function rules and resulting tables and graphs to answer questions about the problem situations.

a. How can the height from which an object is dropped or launched be seen in a table of (*time*, *height*) values? On a graph of height over time? In a rule of the form $h = h_0 + v_0t - 16t^2$ giving height as a function of time?

b. How could you determine the initial upward velocity of a flying object from a rule in the form $h = h_0 + v_0t - 16t^2$ giving height as a function of time?

c. What strategies can you use to answer questions about the height of a flying object over time?

Be prepared to share your ideas and strategies with others in your class.

Check For Understanding

In Game 3 of the 1970 NBA championship series, the LA Lakers were down by two points with three seconds left in the game. The ball was inbounded to Jerry West. He launched and made a miraculous shot from beyond midcourt, a distance of 60 feet, to send the game into overtime (there was no 3-point line at that time).

Check For Understanding (cont.)

a. Suppose the basketball left West's hands at a point 8 feet above the ground. What does that information tell about the rule giving h as a function of t?

b. Suppose also that the basketball reached the basket (at a height of 10 feet) 2.5 seconds after it left West's hands. Use this information to determine the initial upward velocity of the basketball.

c. Write a rule giving h as a function of t.

Check For Understanding (cont.)

d. Use the function you developed in Part c to write and solve equations and inequalities to answer these questions about the basketball shot.

- At what other time(s) was the ball at the height of the rim (10 feet)?
- For how long was the ball higher than 30 feet above the floor?
- If the ball had missed the rim and backboard, when would it have hit the floor?

e. What was the maximum height of the shot, and when did the ball reach that point?

In Conclusion

- There are many different curricula out there that will teach algebra skills to high school students.
- Don’t be afraid to try something new in the classroom, whether it is one new lesson, or an entirely new curriculum.
- You will be surprised what your students will learn, and what you will learn from your students.