Using TI Technology to Increase Student Engagement

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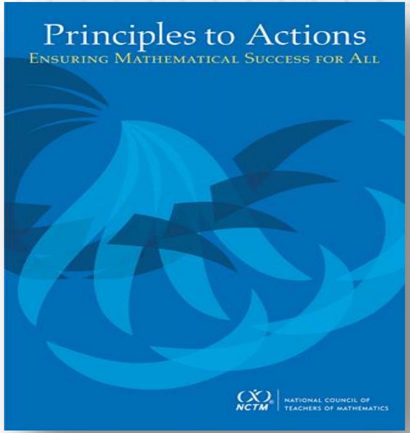
Effective Mathematics Teaching Practices

1. Establish mathematics **goals** to focus learning.
2. Implement **tasks** that promote reasoning and problem solving.
3. Use and connect mathematical **representations**.
4. Facilitate meaningful mathematical **discourse**.
5. Pose purposeful **questions**.
6. Build procedural **fluency** from conceptual **understanding**.
7. Support productive **struggle** in learning mathematics.
8. Elicit and use **evidence** of student thinking.

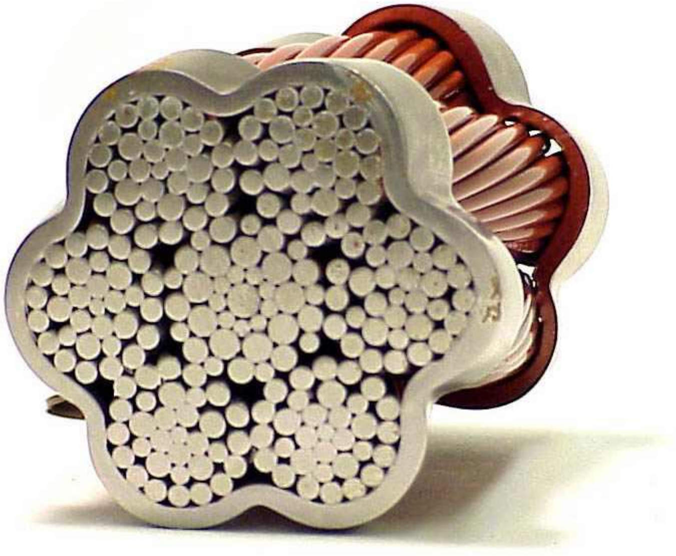


Leinwand, S., Brahier, D.J., Huinker, D., Berry, R.Q., Dillon, F.L., Larson, M.R., Leiva, M.A., … Smith, M.S. (2014). Principles to actions: Ensuring mathematical success for all. Reston, VA: NCTM.

5 Practicing for Orchestrating Productive Mathematical Discussions

1. Anticipating
2. Monitoring
3. Selecting
4. Sequencing
5. Connecting

Compacted Cables



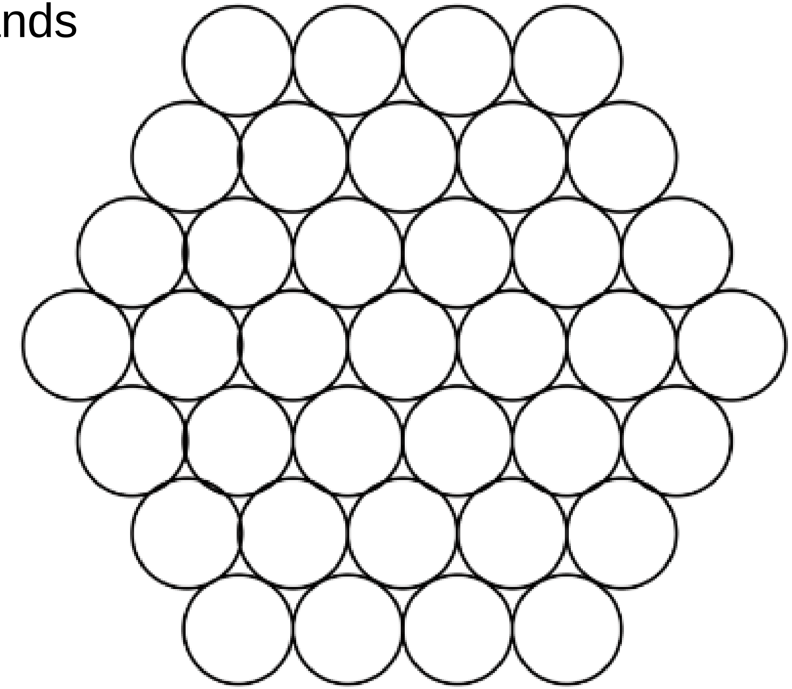
Compacted Cables

Many cables can be compacted together to make a bigger,stronger cable. These stronger cables are used in construction of bridges and tall objects that need to be anchored to the ground. The diagram on the next page is a size 4 hexagonal compacted cable made up of 37 strands.

1. How many strands are needed for a size 12 compacted cable?
2. How many strands are needed for a size n compacted cable?

Compacted Cables

Size 4, 37 strands



Numeric Approach

Size	Numeric Model	Number of wires
4	2(4+5+6) +7	37
5	2(5+6+7+8) +9	61
6	2(6+7+8+9+10)+11	91
7	2(7+8+9+10+11+12)+13	127
8	2(8+9+10+11+12+13+14) +15	169

NORMAL FLOAT AUTO REAL RADIAN MP

L1	L2	L3	L4	L5
4	37	24	6	------
5	61	30	6	
6	91	36	6	
7	127	42	------	
8	169	------		
------	------			

L4(1)=6

NORMAL FLOAT AUTO REAL RADIAN MP

LinReg

y=ax+b

a=33

b=⁻101

r^2=.9885620915

r=.9942645983

NORMAL FLOAT AUTO REAL RADIAN MP

QuadReg

y=ax^2+bx+c

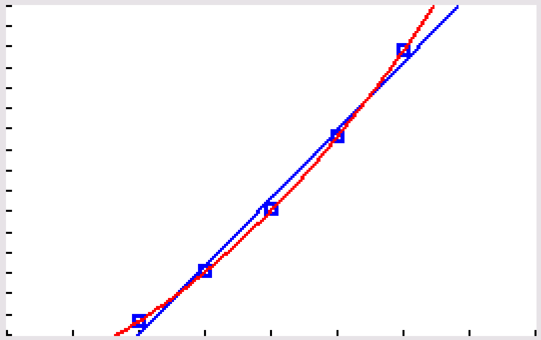
a=3

b=⁻3

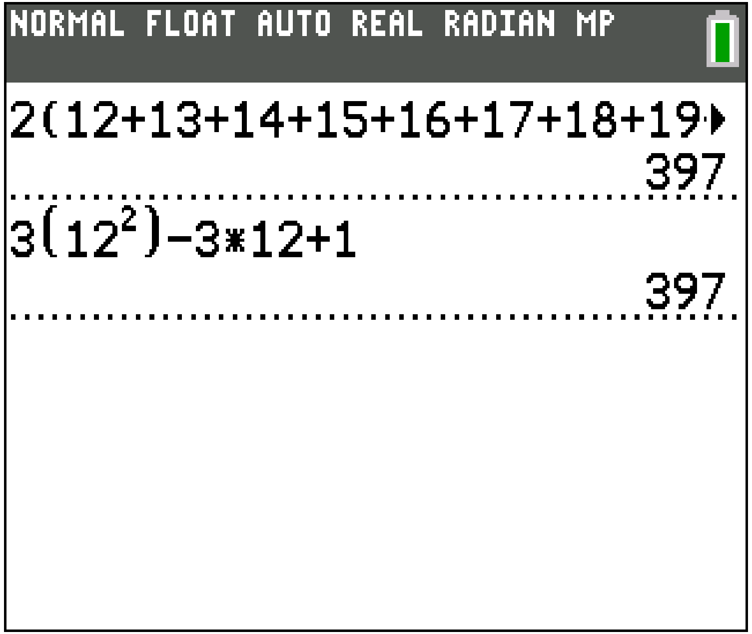
c=1

R^2=1

NORMAL FLOAT AUTO REAL RADIAN MP



Finding number of strands in size 12



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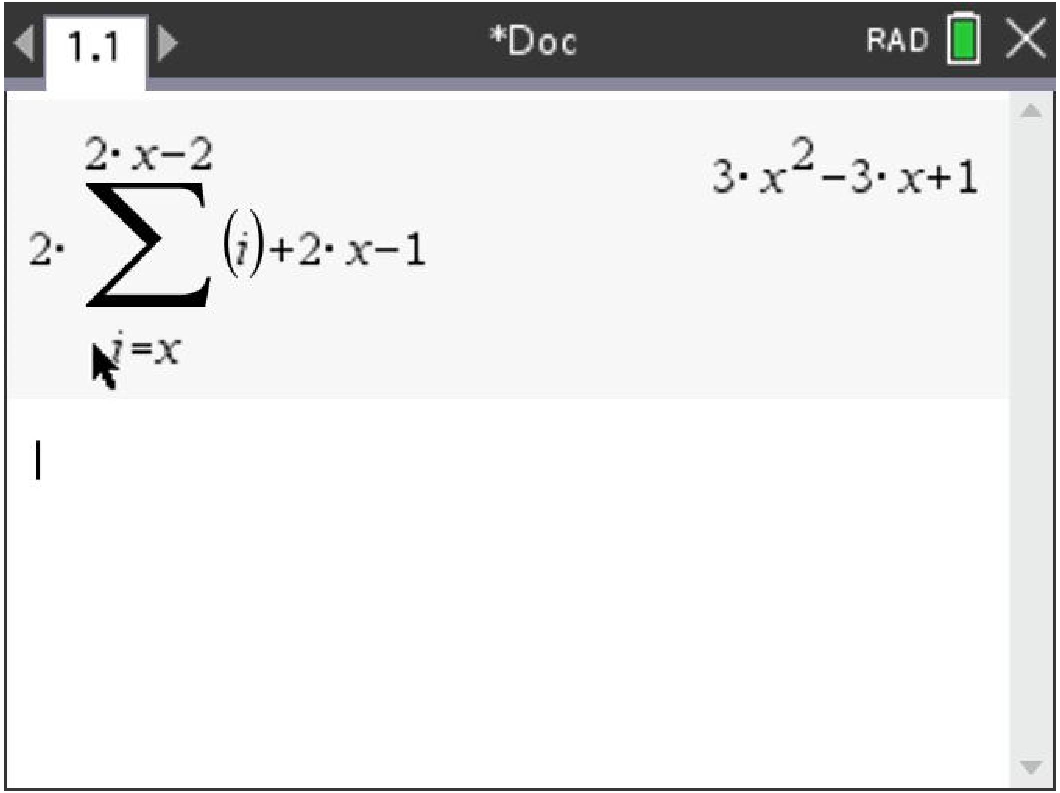
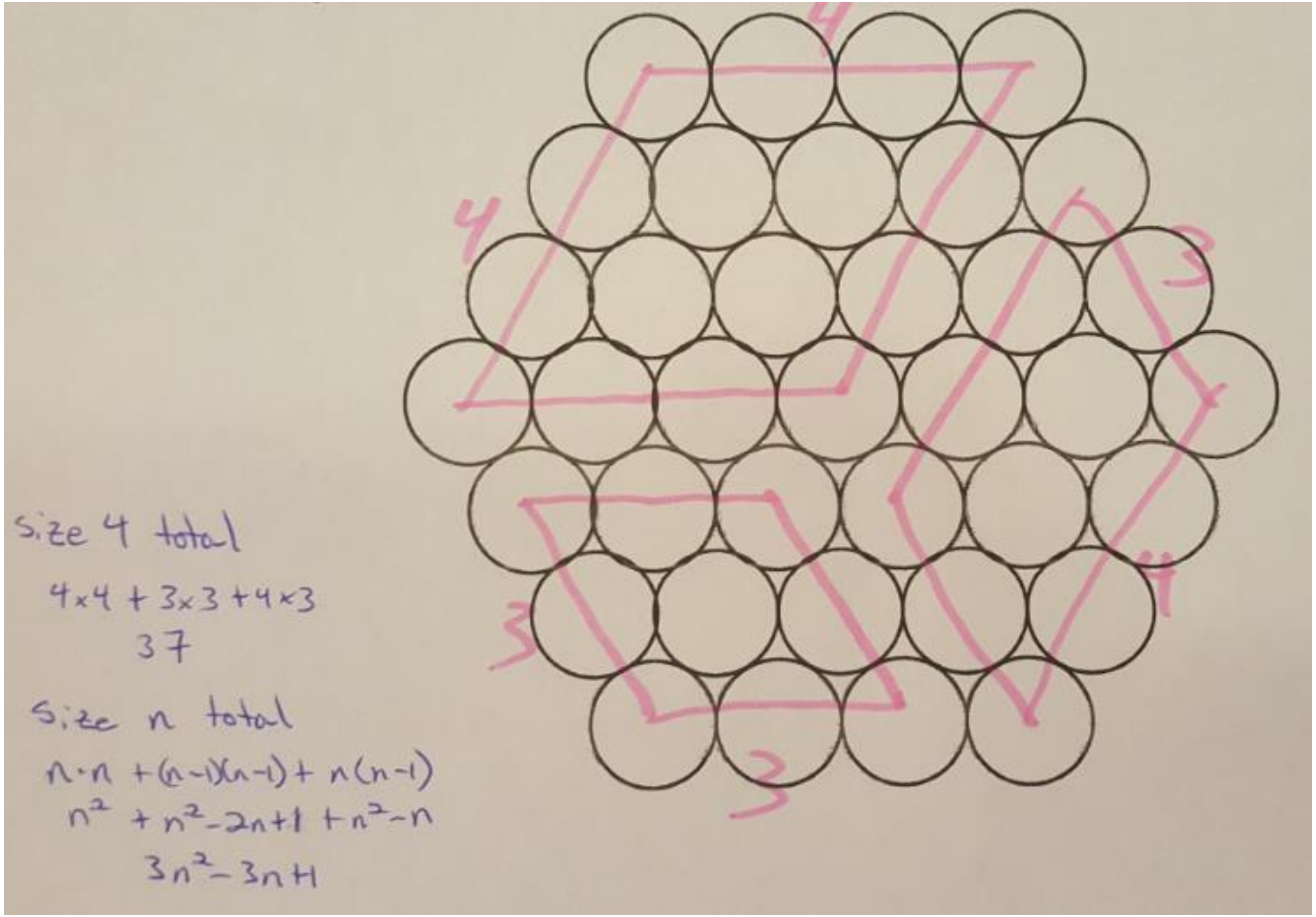
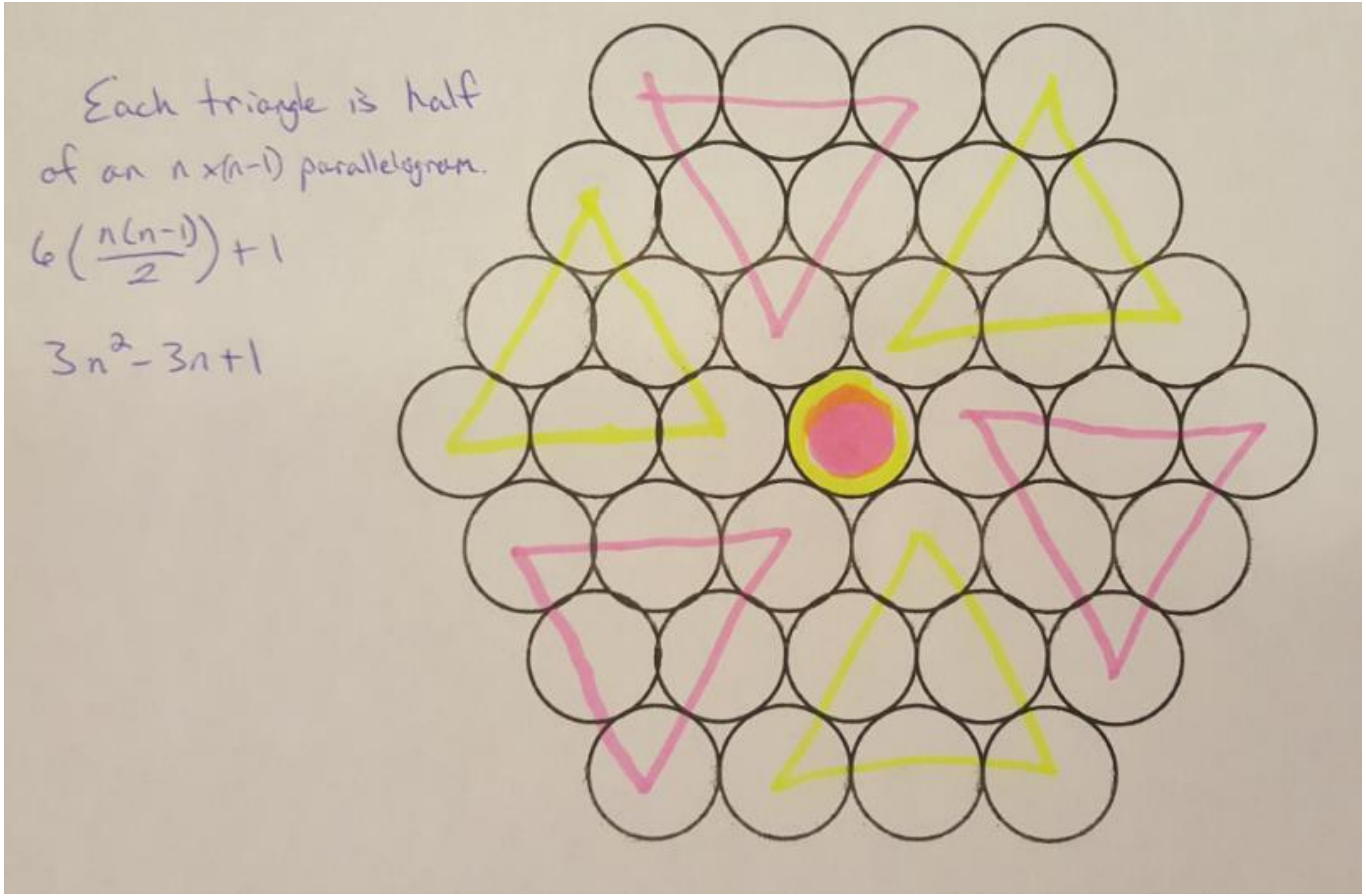
Can the calculator add this up?




4
4
3
4
3
3
size 4 total
4×4 + 3×3 + 4×3
37
size n total
n·n + (n−1)(n−1) + n(n−1)
n² + n²−2n+1 + n²−n
3n²−3n+1


Each triangle is half
of an n x(n-1) parallelogram.
$6\left(\frac{n(n-1)}{2}\right)+1$
$3n^2-3n+1$

First Group Wants to Try an Area Model

Two Trapezoids

Size 4

Top Trapezoid: Base one = 4, base two = 7, height =4, area 22

Bottom Trapezoid: Base one = 4, base two = 6, height =3, area 15

Total: 37

Size n

Top Trapezoid: Base one = n, base two = 2n-1, height n, area (3n^2 - n)/2

Bottom Trapezoid: Base one = n, base two = 2n-2, height n-1, area (3n^2-5n+2)/2

Total: (6n^2-6n+2)/2=3n^2-3n+1

Effective Strategies Related to Compact Cable

Goal: Model with quadratic equations

Promote Reasoning: Why would this model be quadratic?

Representations: Pictorial, Numeric, Algebraic, Graphical, Geometric

Discourse: Students were trying to connect all of their methods that produced the same model.

Purposeful Questions

Why do you think this might be a quadratic model, besides the fact that is what we are studying?

Can you predict what the sum for a size twelve would be without drawing the picture?

How is the last number in the sum related to the size of the cable?

How can you predict the length of the center row from the size of the cable?

Could you decompose this picture some way to help you?

Effective Strategies Related to Compact Cable

Build fluency from conceptual understanding: Using first and second differences to decide on the appropriate model.

Productive Struggle: Did not tell students what to do, let them “struggle” with an approach.

Elicit evidence of student thinking: Ask students to work together in pairs or triads and listen to their conversations. Ask groups to share their thinking with the class.

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Paper Folding

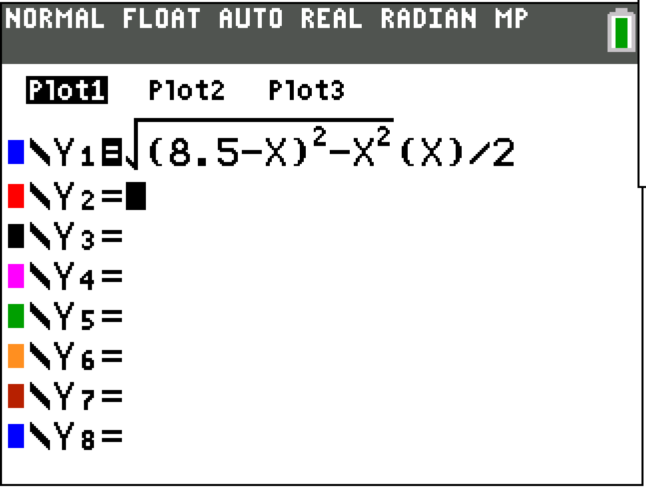
A sheet of 11 in by 8.5 in paper is folded so that the upper right hand corner is touching the bottom of the paper. How far from the lower right hand edge will the corner touch to produce the right triangle with the largest area?

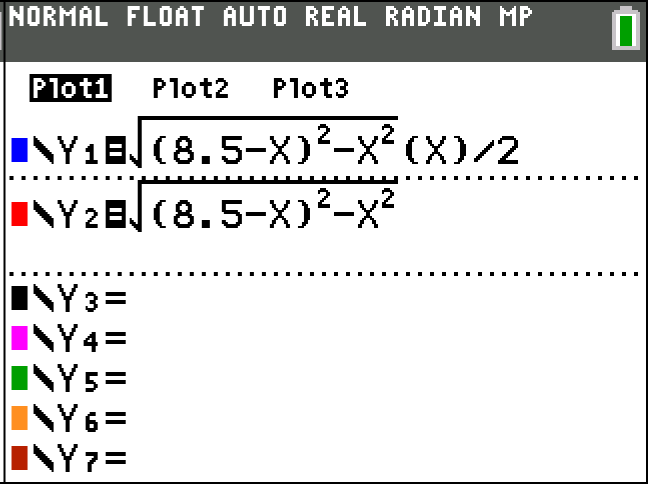
Guess and Check

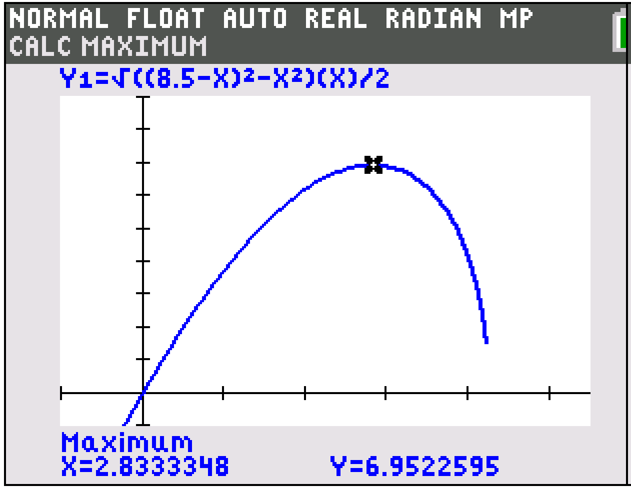
Base (inches)	Height (inches)	Area (square inches)
5.5	2.4375	6.70313
5	2.75	6.875
4	3.25	6.5
4.5	3	6.75

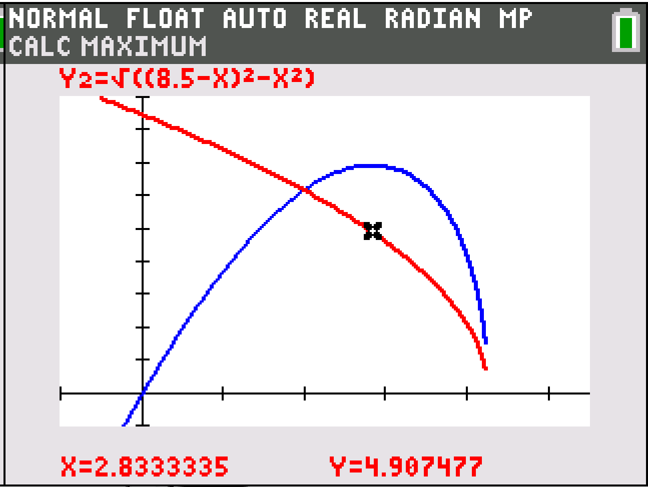
Defining Variables

Height is x









Effective Strategies Related to Compact Cable

Goal: Model with radical functions, maximizing functions.

Promote Reasoning: Why would this model be a radical function?

Representations: Concrete, Pictorial, Numeric, Algebraic, Graphical, Geometric

Discourse: Students were discussing how to define their unknown, why can the final answer not be "x"?

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Purposeful Questions

What kind of triangle is this?

What is that you are trying to find and what do you know?

Can you find the area of one possible triangle?

What do you think might produce the largest triangle and why?

When you let the base be the variable, why do you think you are having trouble finding a representation of the height?

If you could find the height, could you find the base?

Effective Strategies Related to Compact Cable

Build fluency from conceptual understanding: Application of the Pythagorean Theroem.

Productive Struggle: Did not tell students what to do, let them “struggle” with an approach.

Elicit evidence of student thinking: Ask students to work together in pairs or triads and listen to their conversations. Ask groups to share their thinking with the class.

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Thanks for coming!

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