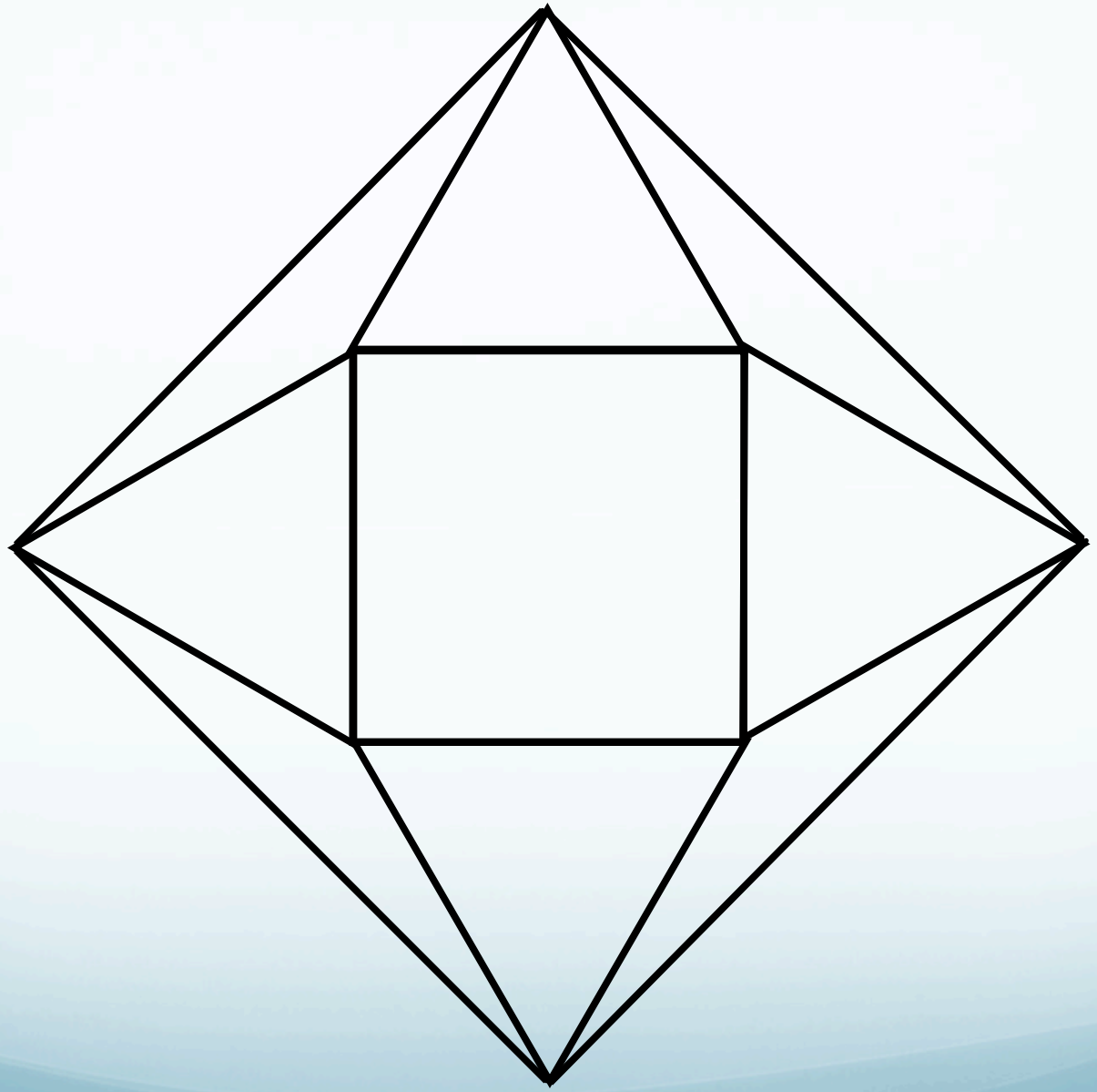

Noticing and Wondering to Promote Problem Solving

NCTM – Boston
April 17, 2015

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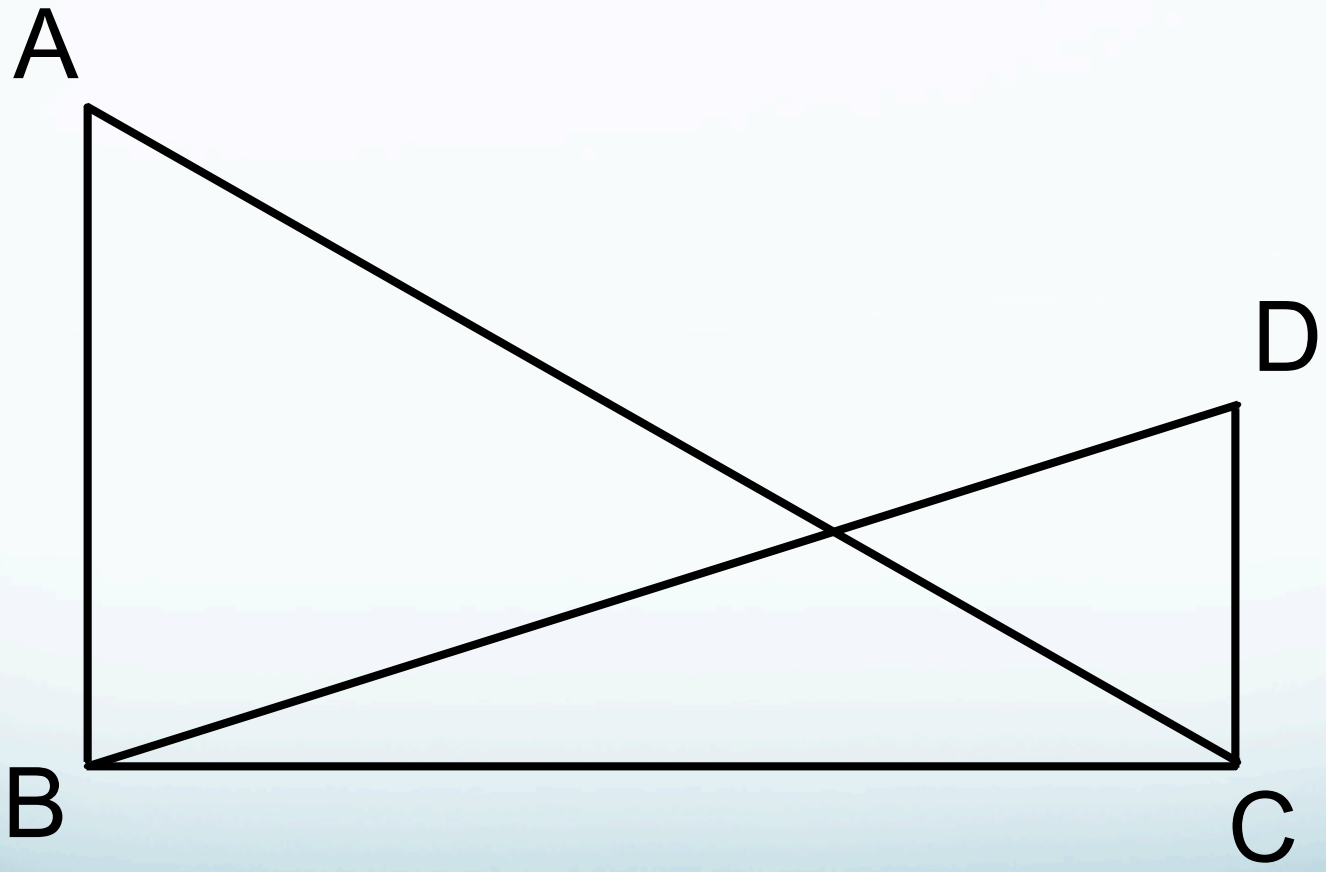
Objectives

1) Learn how to restructure problems to take advantage of what students notice and wonder, making problems accessible to all students.
2) See how hands-on approaches can be integrated with technology approaches for the same problem.
3) Learn practical tips for promoting student discourse and active participation of all students.
4) Leave with three examples of tasks you can use in your classroom & maybe even a door prize!

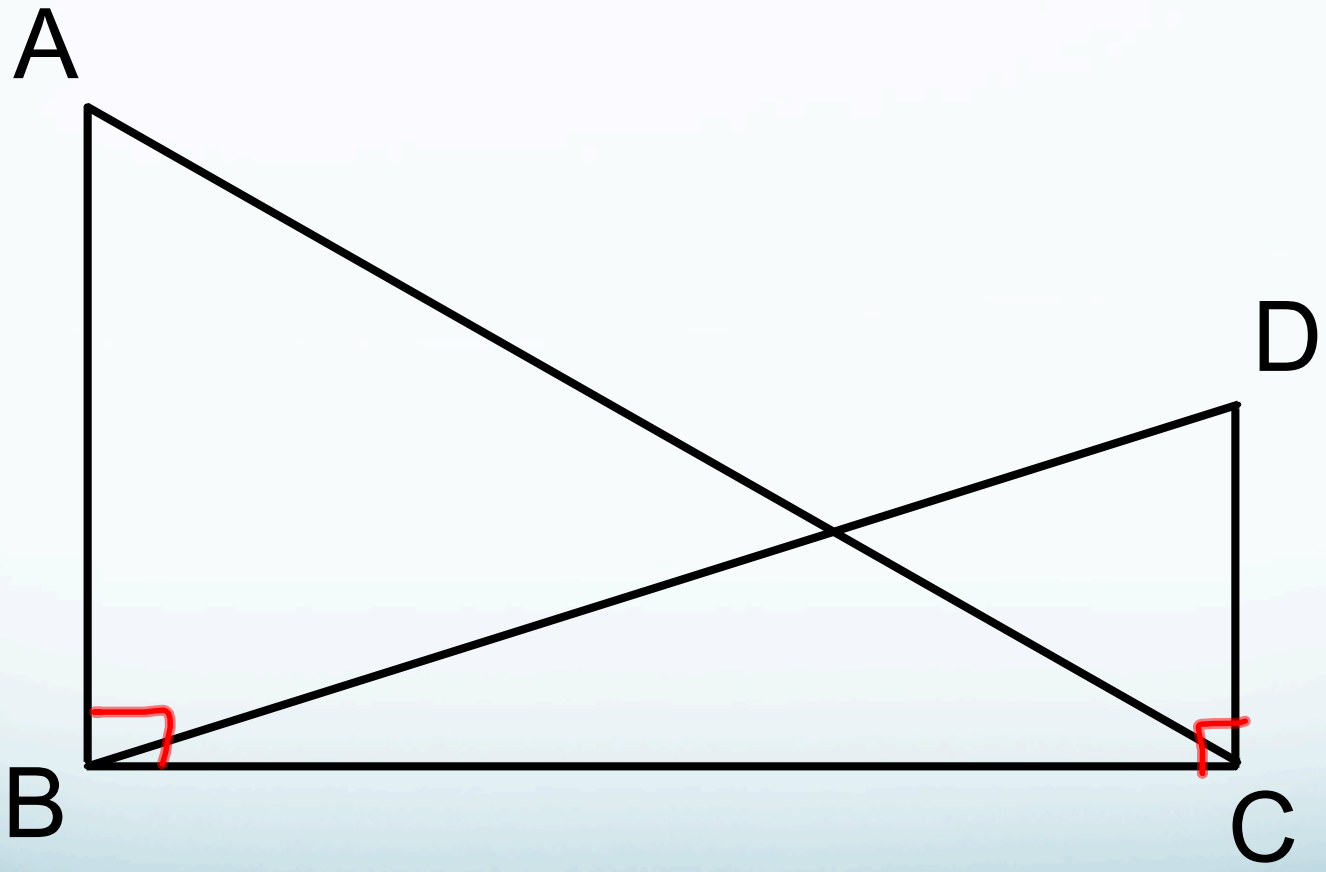
Restructure & Accessibility

1) No words
2) No numbers
3) Minimal markings
4) “What do you notice? What do you wonder?”
5) All students can be successful.
6) Students don’t look at problems and say “Huh?”

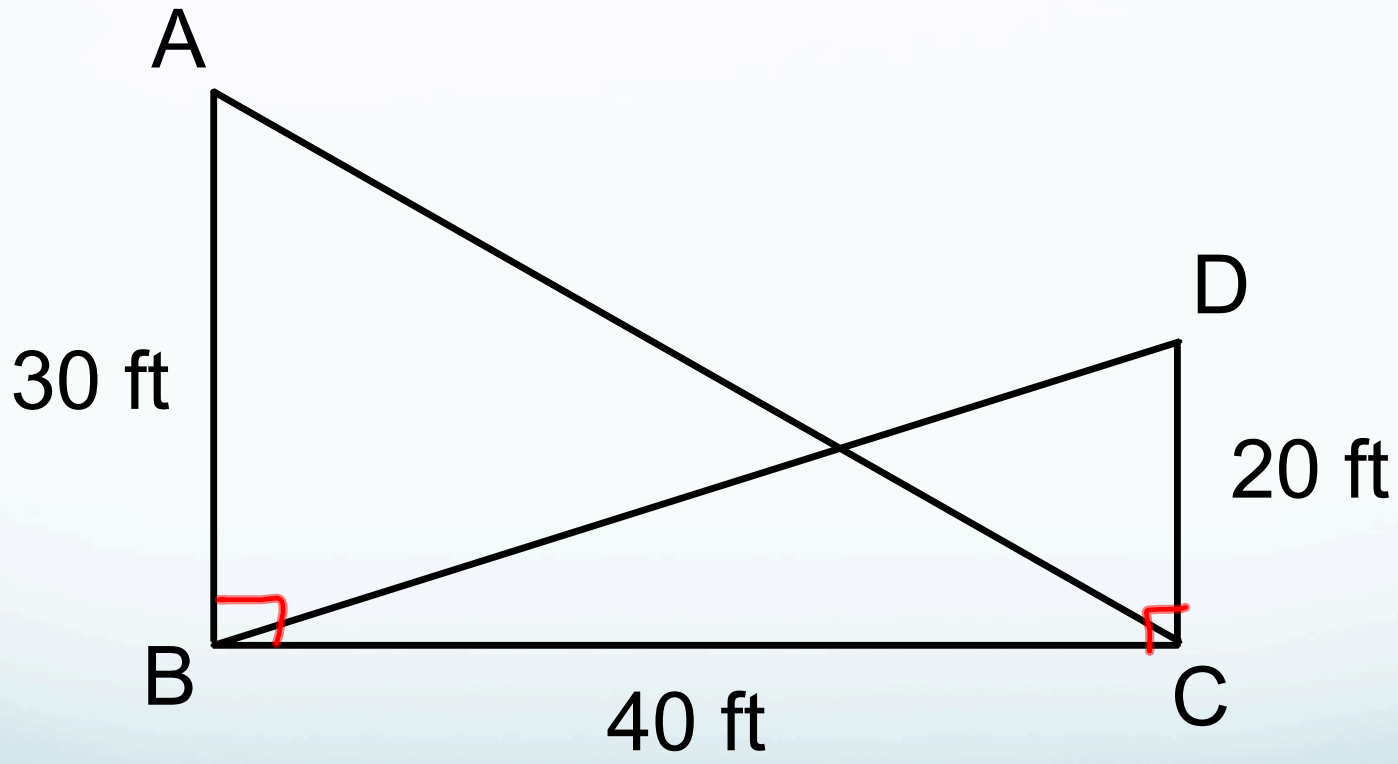
Example #1



Example #1

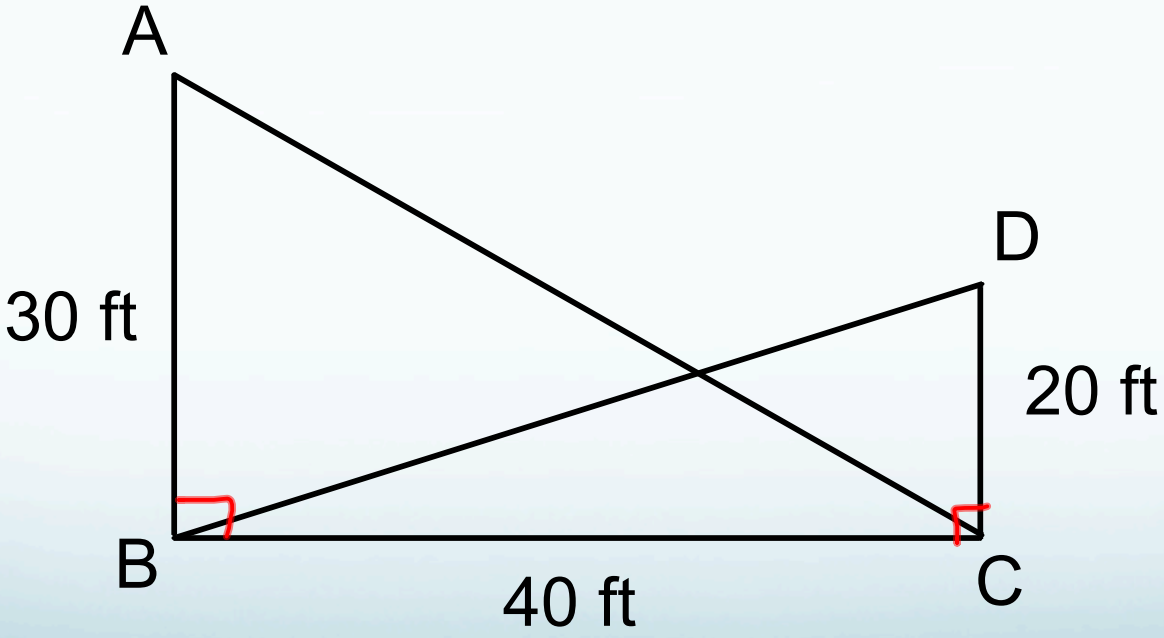


Example #1



Example #1

Two poles are erected perpendicular to the ground 40 ft apart. The poles are 30 ft tall and 20 ft tall. Two supporting wires are shown, each running from the top of one pole to the bottom of the other. How high is the crossing point of the two wires?

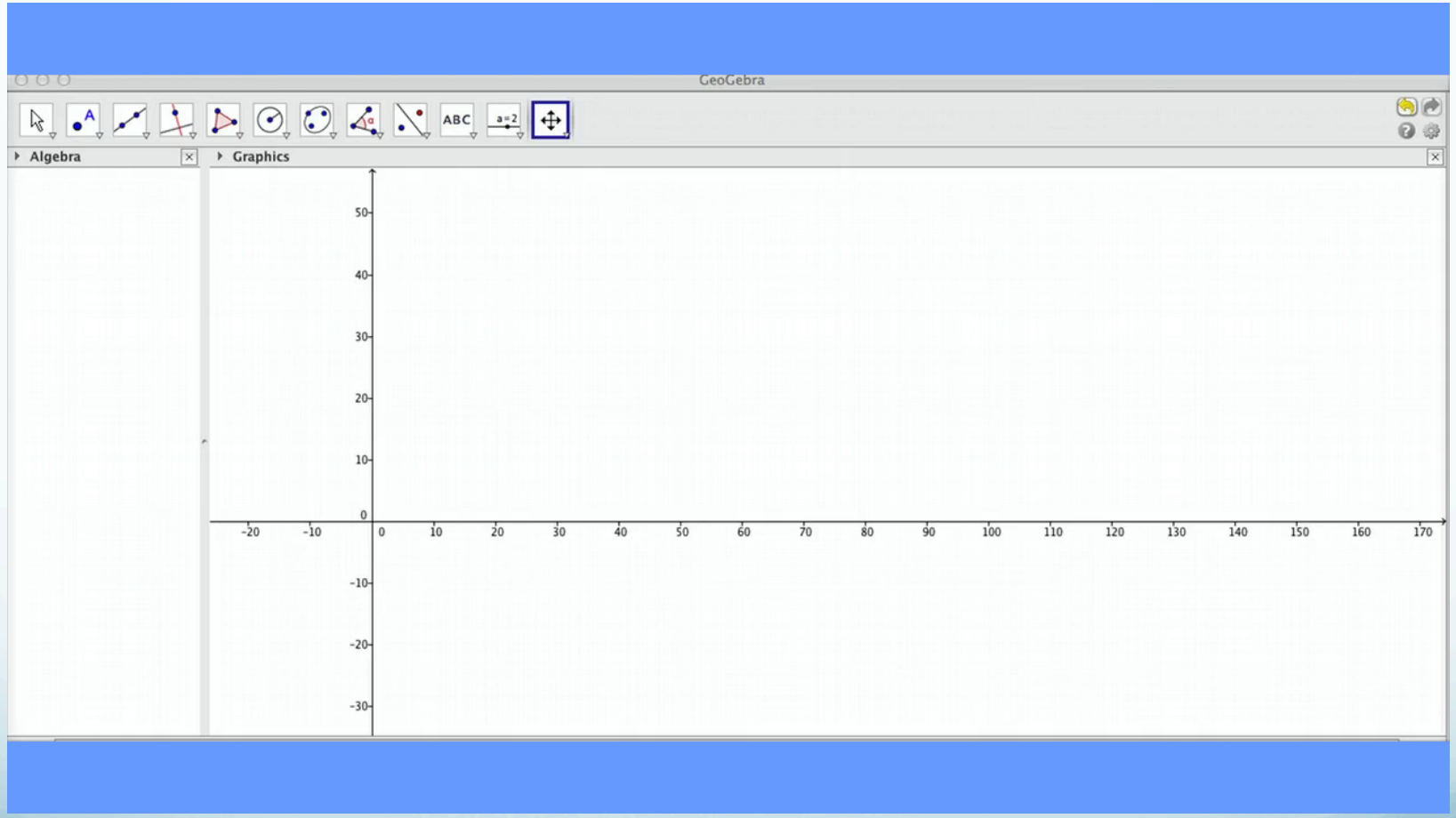


Example #1

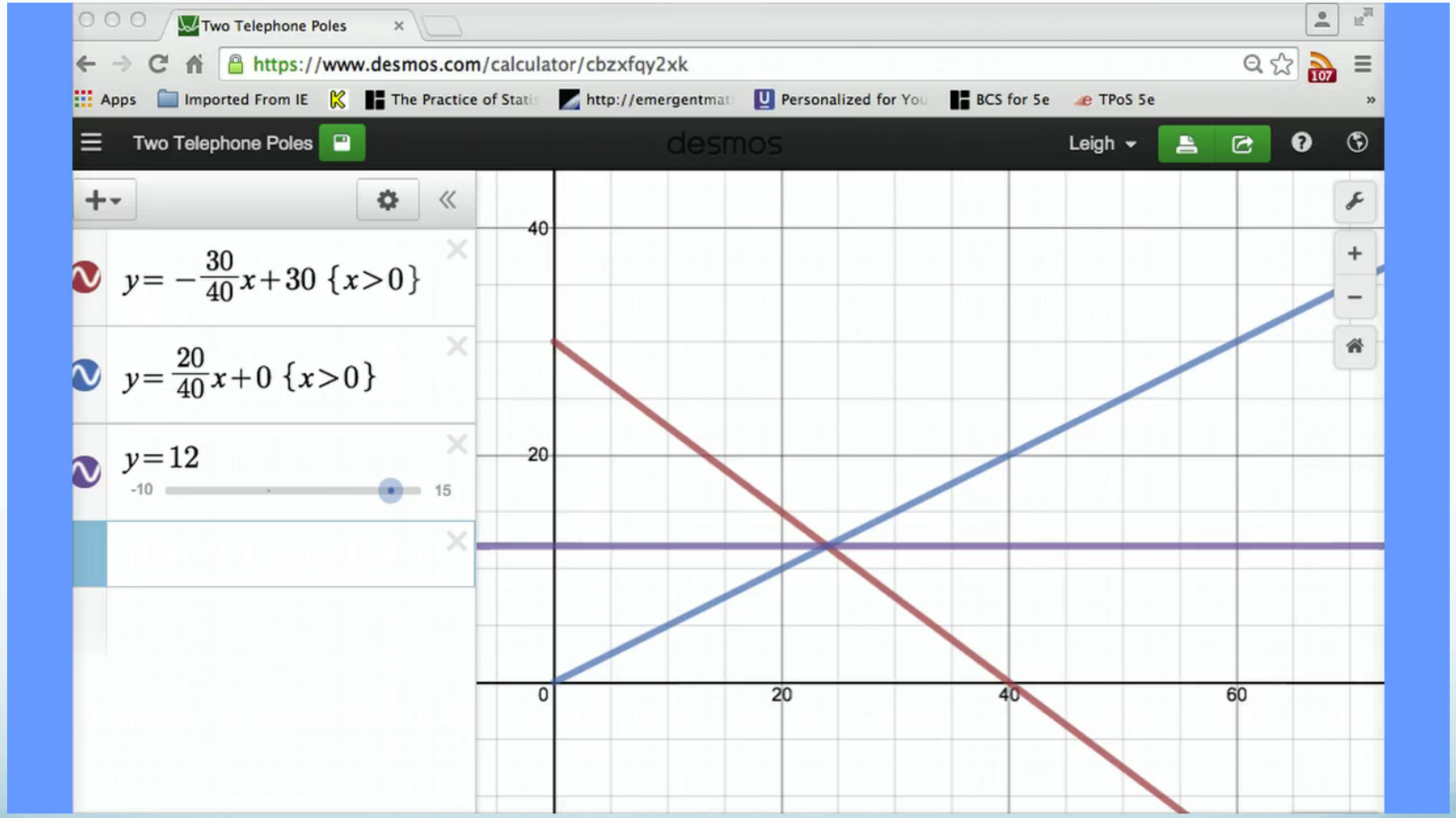
- Low tech/concrete – graph paper
- Low tech/abstract – similar triangles
- Low tech/abstract – equations of lines
- High tech/abstract – explore changes dynamically

"The meeting point of the wires must be 15 feet above the ground. How should the poles be moved to make this happen?"

Example #1


GeoGebra
Algebra
Graphics
ABC
a=2
50
40
30
20
10
0
-10
-20
-30
-20
-10
0
10
20
30
40
50
60
70
80
90
100
110
120
130
140
150
160
170

Example #1


Two Telephone Poles
https://www.desmos.com/calculator/cbzxfqy2xk
Apps
Imported From IE
The Practice of Stati
http://emergentmat
Personalized for You
BCS for 5e
TPoS 5e
Two Telephone Poles
desmos
Leigh
$y=-\frac{30}{40}x+30\ \{x>0\}$
$y=\frac{20}{40}x+0\ \{x>0\}$
$y=12$
-10
15
40
20
0
20
40
60

A Word about Technology

1) Concrete before abstract.
2) Don’t start with technology.
3) Technology will take more time, initially.
4) Screencasts can help students learn the basics.
5) Learning is social.

Example #2

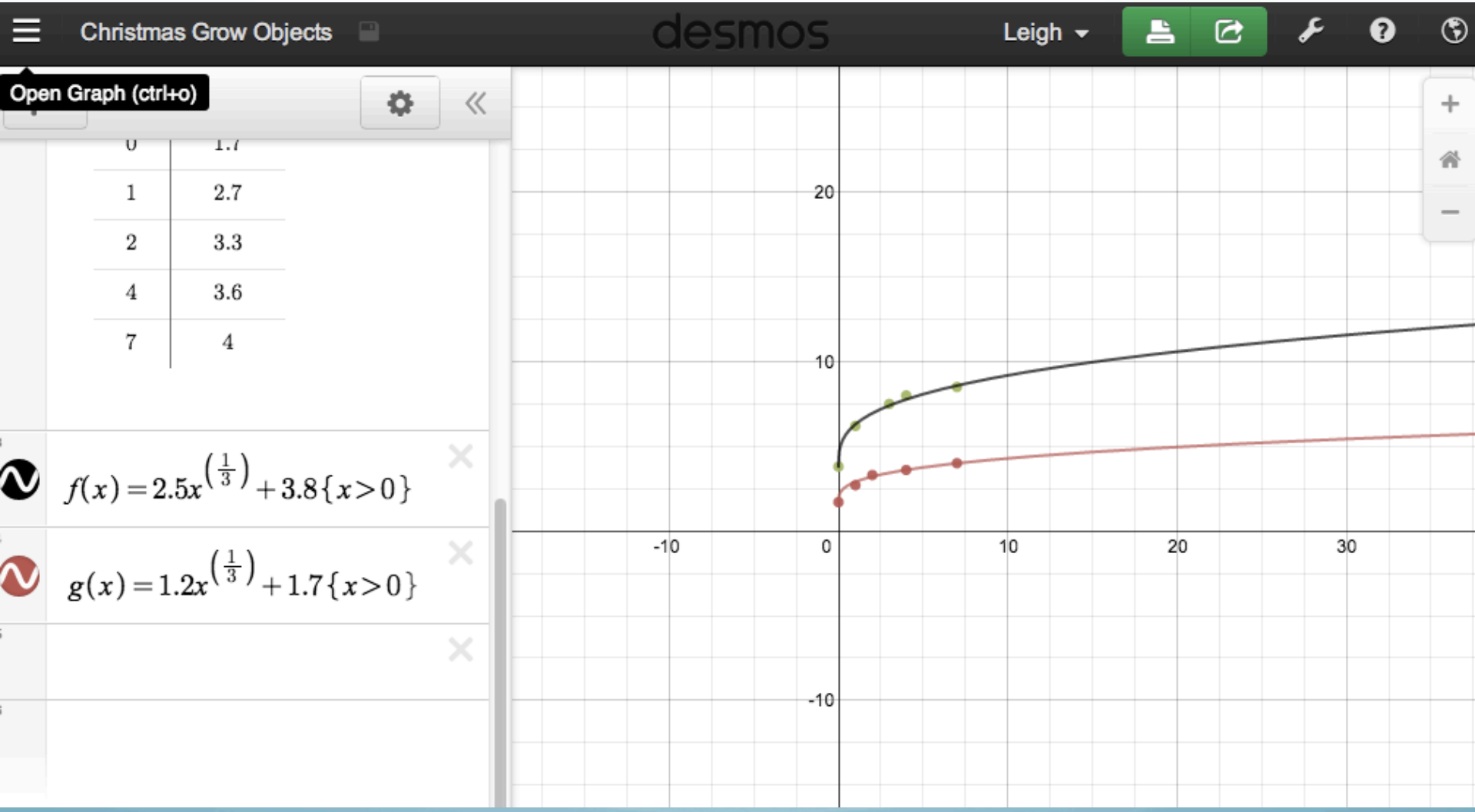

GROW YOUR OWN
GROW A POLAR BEAR
ÉLEVEZ UN OURS BLANC
CREZCA UN OSO POLAR
1pc
3+
WARNING: CHOKING HAZARD
Small parts. Not for children under 3 years.
AVERTISSEMENT: RISQUE DE OBSTRUCTION
ADVERTENCIA: PELIGRO DE OBSTRUCCIÓN

Example #2

What does growing 600% look like?

I wonder…will it grow the same amount every day?

Example #2


Christmas Grow Objects
desmos
Leigh
Open Graph (ctrl+o)
0 1.7
1 2.7
2 3.3
4 3.6
7 4
$f(x)=2.5x^{\left(\frac{1}{3}\right)}+3.8\{x>0\}$
$g(x)=1.2x^{\left(\frac{1}{3}\right)}+1.7\{x>0\}$
20
10
-10
-10
0
10
20
30

Example #2

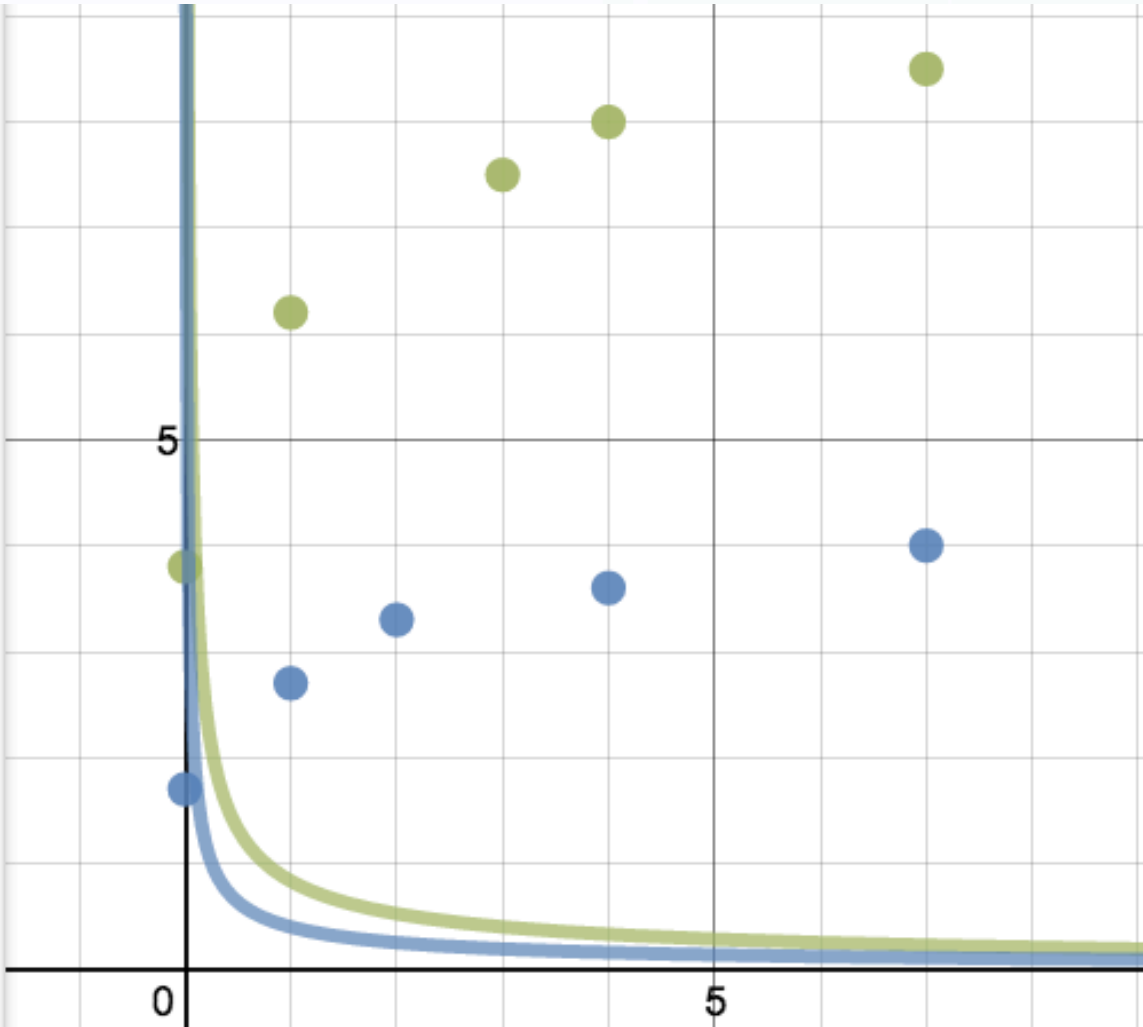
7	4

$f(x) = 2.5x^{\left(\frac{1}{3}\right)} + 3.8\{x$

$g(x) = 1.2x^{\left(\frac{1}{3}\right)} + 1.7\{x$

$F(x) = \frac{d}{dx} f(x)$

$G(x) = \frac{d}{dx} g(x)$



Classroom of Collaboration

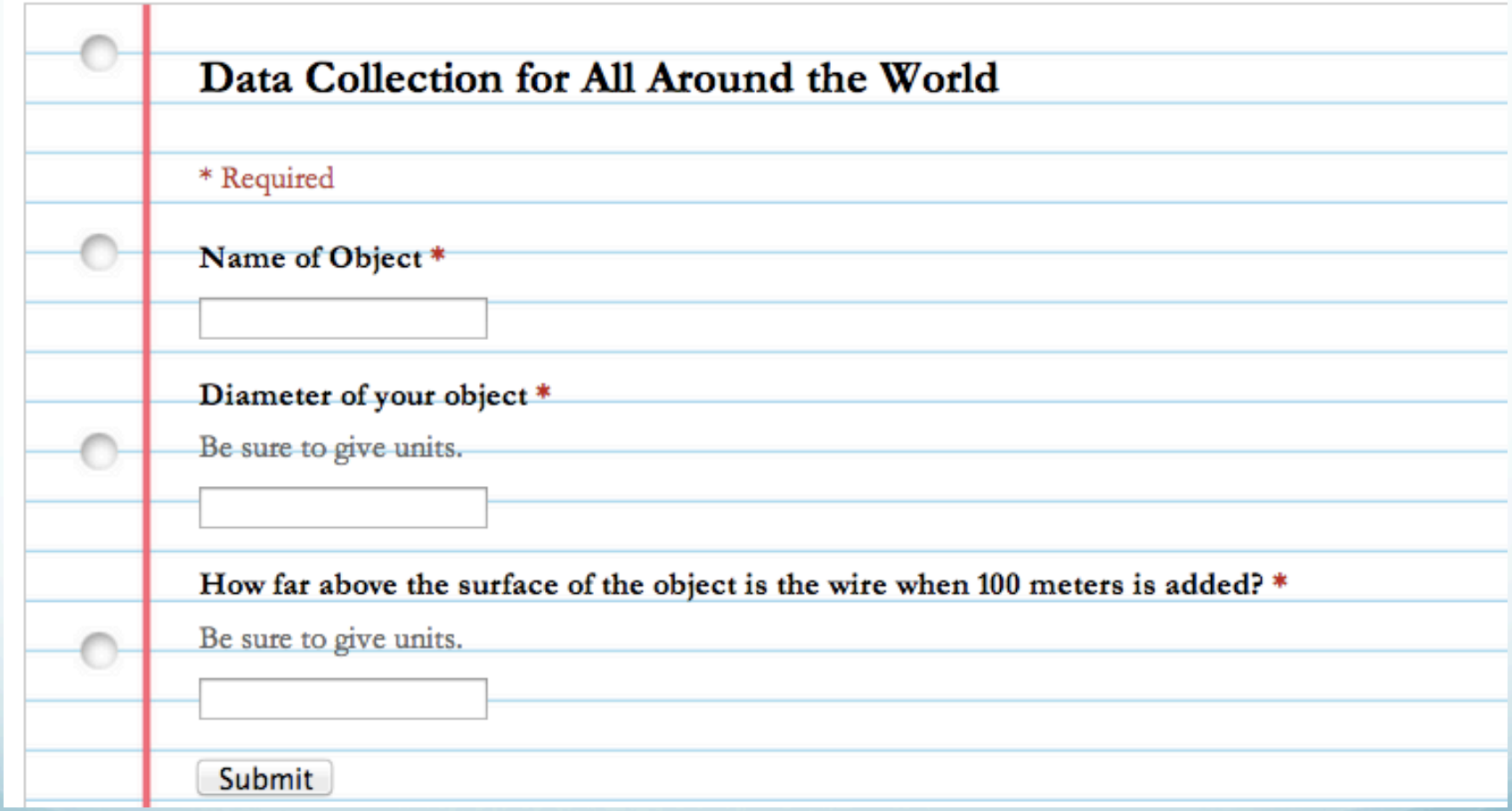
1) It is ok to be wrong!
2) Students helping each other daily.
3) If I explain it, then they explain it.

Example #3

Example #3

Imagine that the Earth is a perfect sphere, and that a metal wire is snugly wrapped around its equator. Now imagine that we cut this wire in one spot and splice in an additional 100 meters of wire. We take up the slack by using posts to raise the wire an equal distance all the way around the Earth. How high above the surface of the earth will the wire be?

Example #3



Data Collection for All Around the World

* Required

Name of Object *

Diameter of your object *

Be sure to give units.

How far above the surface of the object is the wire when 100 meters is added? *

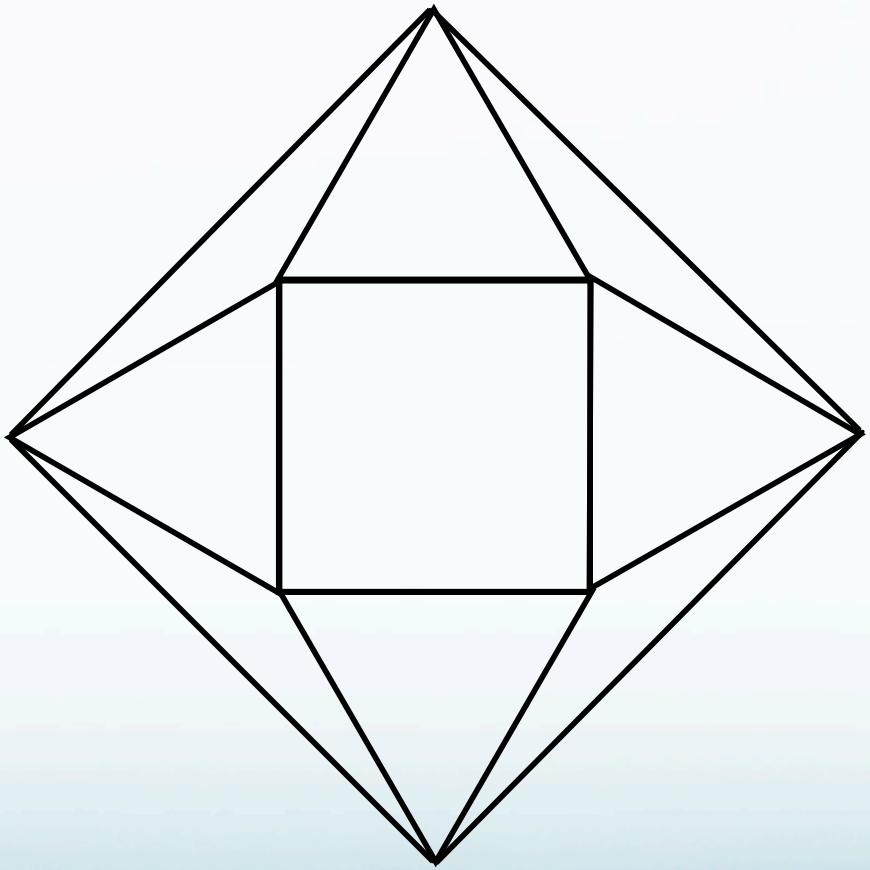
Be sure to give units.

Submit

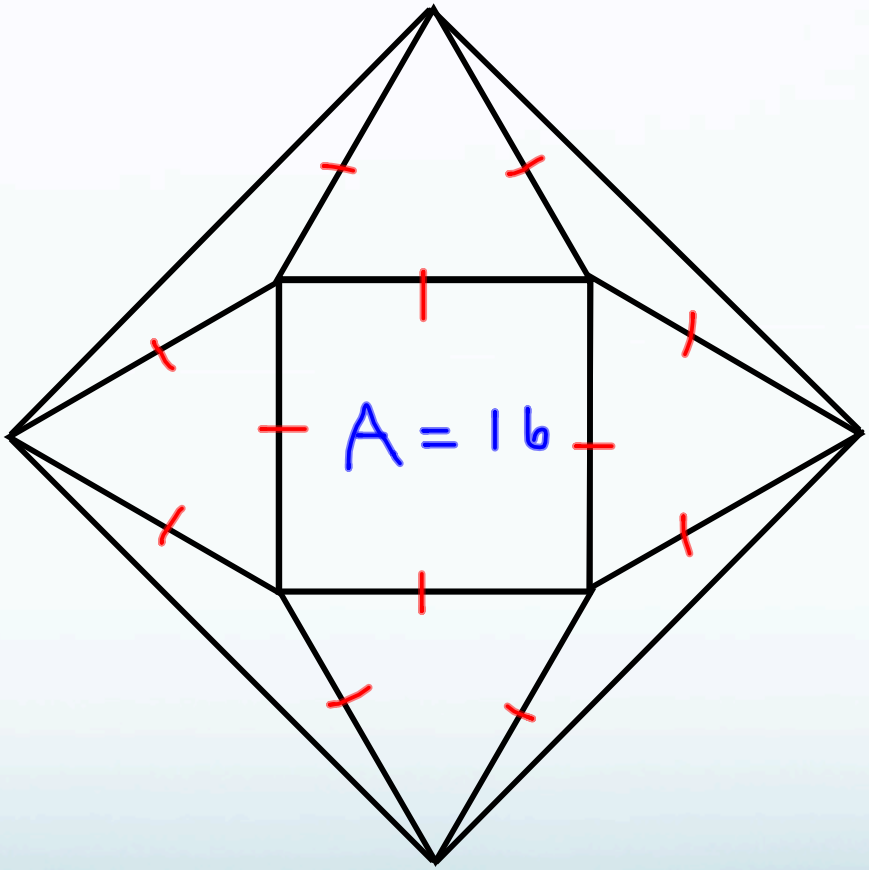
Example #3

	B	C	D
	Name of Object	**Diameter of your object**	**How far above the surface of the object is the wire when 100 meters is added?**
3	Earth Ball	1 m	15.9 m
3	Jupiter	139,822,000 m	15.9 m
9	BEACH BALL	0.6 m	15.9
2	moon	3474800 m	15.9 m

Bonus Example & Door Prize!



Bonus Example & Door Prize!



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