

Unit 9: Solving word problems

word questions
 → 2 unknowns
 → vertex / x-ints

is 2 unknowns that can be written as a 2nd degree equation

e.g. Find 2 non-negative integers whose difference is 18 and whose product is 544

Step ①: Identify the 2 unknowns
 x: first number
 y: 2nd number

Step ②: Construct 2 equations involving the unknowns.
 [Strategy: Translate the sentences into equation]
 [Strategy: think of the equation that applies to the context]

① $x - y = 18$
 ② $x \cdot y = 544$

Step ③: Make one (2nd degree) equation w/ one unknown by using Comparison Method:

$$\begin{array}{l} x - y = 18 + y \\ \text{F.S.} \\ x = 18 + y \end{array} \quad \left| \quad \begin{array}{l} x \cdot y = 544 \\ \text{R.S.} \\ x = \frac{544}{y} \end{array} \right.$$

- i. isolate one unknown in both equations
- ii. make one equation by putting the right sides equal to each other
- iii. cross multiply, bring everything to one side, and use to quad formula to solve

$$\frac{18 + y}{1} = \frac{544}{y}$$

$$y(18 + y) = 544$$

$$18y + y^2 = 544$$

$$y^2 + 18y - 544 = 0$$

a = 1
 b = 18
 c = -544

$$\Delta = b^2 - 4ac$$

$$\Delta = (18)^2 - 4(1)(-544)$$

$$\Delta = 2500$$

$$y = \frac{-b \pm \sqrt{\Delta}}{2a}$$

$$y_1 = \frac{-18 + \sqrt{2500}}{2(1)}$$

$$y_1 = 16 \text{ or}$$

$$y_2 = \frac{-18 - \sqrt{2500}}{2(1)}$$

~~$y = -34$~~ context says not allowed.

Step ④: Find the other unknown by subbing in $y = 16$ into one of the original equations.

sub $y = 16$ into ①

$$x - 16 = 18$$

$$x - 16 = 18 + 16$$

$$x = 34$$

Recall: to solve for a 1st degree unknown, isolate x (opposite operation)

∴ the 2 non-negative #'s are 16 and 34.

Two consecutive even numbers have
a ^xproduct of 8.

x : a number

y : the second
#

$$x \cdot y = 8$$

$$x + 2 = y$$

P 9.8 Step ①: unknowns
 x = the price of one ball
 y = the # of balls

Step ②: Equations (context equation)

total cost = cost per thing · # of things

original eqn
 ① $60 = x \cdot y$

altered case
 ② $60 = (x-1)(y+5)$

Step ③: make one equation

~~$x \cdot y = 60$~~
 $y = \frac{60}{x}$

~~$(x-1)(y+5) = 60$~~
 $y+5 = \frac{60}{x-1} - 5$

$y = \frac{60}{x-1} - 5$

TIP: start by isolating the y bracket

are equations

$\frac{60}{x} = \frac{60}{x-1} - \frac{5(x-1)}{1(x-1)}$

TIP: Make one full complete fraction on both sides before cross multiplying.

$\frac{60}{x} = \frac{60 - 5(x-1)}{x-1}$

$\frac{60}{x} = \frac{60 - 5x + 5}{x-1}$

~~$\frac{60}{x} = \frac{65 - 5x}{x-1}$~~

cross multiple

~~$60(x-1) = x(65-5x)$~~
 ~~$60x - 60 = 65x - 5x^2$~~

$5x^2 - 5x - 60 = 0$

use quad formula

$a=5$
 $b=-5$
 $c=-60$
 $\Delta = b^2 - 4ac$
 $\Delta = (-5)^2 - 4(5)(-60)$
 $\Delta = 1225$

$x = \frac{-b \pm \sqrt{\Delta}}{2a}$
 $x_1 = \frac{-(-5) \pm \sqrt{1225}}{2(5)}$
 $x_1 = 4 \text{ or } 10$

$x_2 = \frac{-(-5) - \sqrt{1225}}{2(5)}$

can't have a negative value for the price \$

~~$x_2 = -9$~~

Step ④ Sub $x=4$ into ①

④ $x \cdot y = 60$

~~$4 \cdot y = 60$~~
 $y = 15$

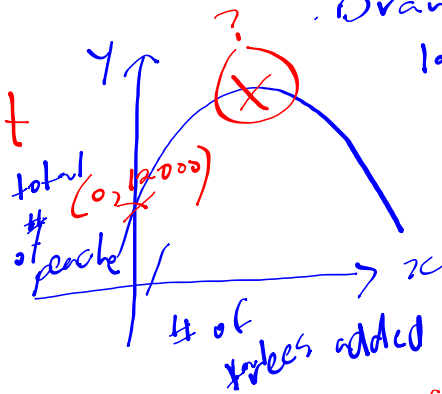
\therefore the cost of one ball is 4 piase.

P 9.11
1.

Unit 8: Word Questions Involving
a max or min point (and more)
 (vertex!)

Strategies

P.11/0.1 Determine
 how extra trees
 to maximum profit



- Draw sketch
- label
- plot points

Now apply
 appropriate
 equation

$$V\left(\frac{-b}{2a}, \frac{-\Delta}{4a}\right)$$

$$y = -10x^2 + 100x + 12000$$

$$V\left(\frac{-100}{2(-10)}, \frac{-490000}{4(-10)}\right)$$

$$V\left(\underset{x}{5}, \underset{y}{12250}\right)$$

- ★ Identify the point in question on the sketch
- ★ Translate the question into a point on the graph.

$$\begin{aligned} a &= -10 & \Delta &= b^2 - 4ac \\ b &= 100 & & \\ c &= 12000 & \Delta &= 100^2 - 4(-10)(12000) \\ & & &= 490000 \end{aligned}$$

∴ the friendly
 must add 5
 trees.

¶ 8.6 #1

$$h = -5t^2 + 20t + 30$$

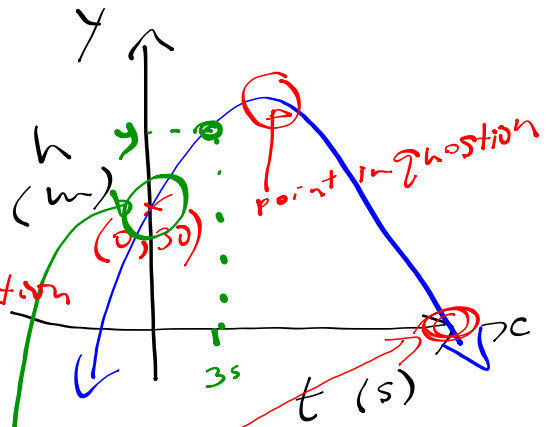
$$y = ax^2 + bx + c$$

How high was the ball after 3 seconds. $t=3 \rightarrow$ sub into equation

How long does it take for the ball to reach the ground?

How high was the person standing when they throw the ball?

y-int $(0, c)$



x-ints \rightarrow what equation? quad formula!