Math 62: GC - 2nd

Solving equations graphically using GC.

+ Identities and Contradictions

Math 72: 3.1

Solving equations graphically using GC.

and

Classifying equations as identities, contradictions or conditional.

Math 70 4.5 Approximating the Solution(s) to an Equation Using the Graphing Calculator

Intersection of Graphs Method:

1) Solve $2\pi x - 5.6 = 7(x - \pi)$ graphically using your graphing calculator.
   (a) For this equation, what function(s) do you graph in your calculator?

   (b) For the method you chose, where/how do you find the solution(s)?

   (c) Round the solution to four decimal places.

x-intercepts Method:

2) Solve $2\pi x - 5.6 = 7(x - \pi)$ graphically using your graphing calculator.
   (a) For this equation, what function(s) do you graph in your calculator?

   (b) For the method you chose, where/how do you find the solution(s)?

   (c) Round the solution to four decimal places.

Solving Linear Equations Graphically

1) Solving equations using intersection of graphs method on GC
   (GC 22) - lesson 10 4.1, 4.2, 4.3

2) Solving equations using the x-intercepts method on GC
   (GC 23)

In the real world, equations often include many complexities that make them difficult to solve (and possibly impossible to solve) by isolating the variable or other algebraic methods.

Instead, we use a calculator or computer to approximate the solutions, using either of two methods.

Example: $2\pi x - 5.6 = 7(x - \pi)$

L.H.S. "left hand side" — R.H.S. "right-hand side"

Method 1: Intersection of graphs (GC22)

In GC: $Y_1 = LHS$
$Y_2 = RHS$

Solutions are where graphs intersect. → Solutions are x-coordinates (ignore y)

2nd TRACE = CALC Menu. 5. Intersect

Method 2: x-intercepts of difference (GC 23)

$$\begin{array}{rr} LHS & = RHS \\ -RHS & -RHS \\ \hline LHS - RHS & = 0. \end{array}$$

Solutions are x-coordinates (ignore y-coords)

In GC: $Y_1 = LHS - RHS$

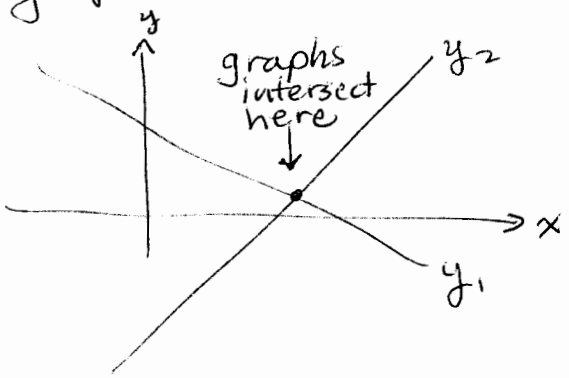
2nd TRACE = CALC Menu 2. Zero

Math 70

Vocabulary: Intersect vs. Intercept

* These are different and not interchangeable! *

to intersect: This is a verb, and means that two graphs cross each other.

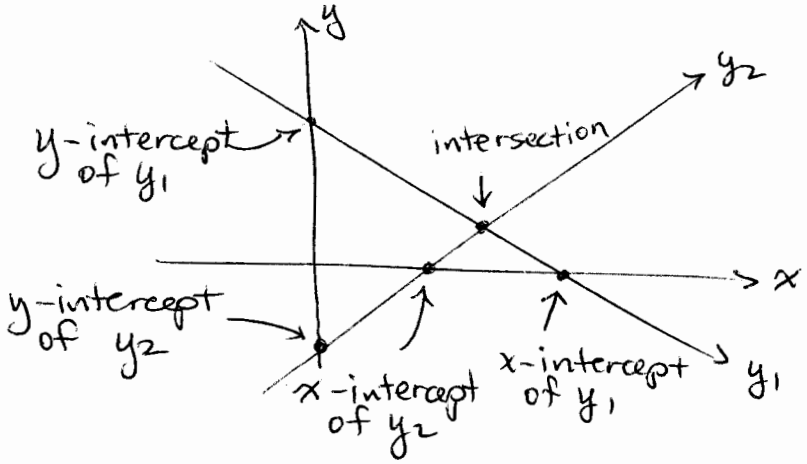


intersection: This is the noun that goes with "to intersect", and refers to the point where the graphs cross.

intercept: This is a noun in math, and must have more information to make sense.

x-intercept: The point where a graph crosses the x-axis.

y-intercept: The point where a graph crosses the y-axis.



Math 70

In an English language usage, "intercept" can be used as a verb, as in:

"The police officer intercepted the suspect three blocks later."

But we do not use "intercept" as a verb in math class.

For Spanish speakers, it's confusing because the two cognates are legitimate synonyms.

intersect = intersectar, cruzarse entrecruzar, interceptar

intercept = interceptar, atajar, atajar por en medio, cortar el paso a, cortar la retirada a, intersectar

But here are the two words that are most like English.

interceptar = intercept

intersectar = intersect

Math 70

Intersection Method:

① Solve the equation graphically. Round solution to the nearest ten-thousandth.

$$2\pi x - 5.6 = 7(x-\pi)$$

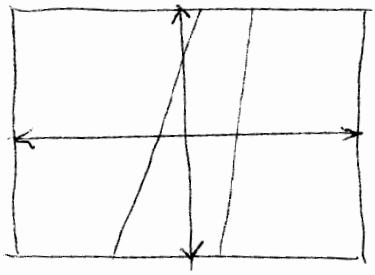
LHS ⇑ RHS

In GC: [Y=]

Y_1 = LHS
Y_2 = RHS

$Y_1 = 2\pi x - 5.6$
$Y_2 = 7(x-\pi)$

Graph in a standard window:



The lines look almost parallel. But are they parallel?

$Y_1 = 2\pi x - 5.6$
has slope $m = 2\pi \approx 6.3$

$Y_2 = 7(x-\pi) = 7x - 7\pi$
has slope $m = 7$.

$6.3 \neq 7$ slopes are different.
These lines do intersect.
Where?
Somewhere above current screen ⇒ increase YMAX.
May need to increase XMAX.

* Play with your [WINDOW] settings until you can see the point of intersection.

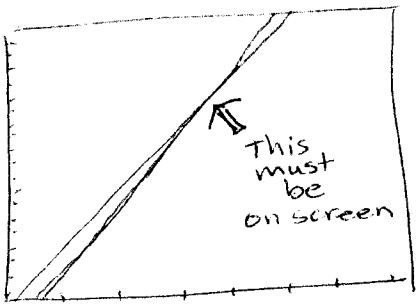
If it's not visible, your GC cannot find it.

Math 70

Intersection Method, continued.

WINDOW for example

XMIN = 0
XMAX = 40
XSCL = 5
YMIN = 0
YMAX = 180
YSCL = 10



You MIGHT ALSO use ZOOM OUT and then ZOOM IN.
What window settings are used doesn't matter, only that the point of intersection must be visible.

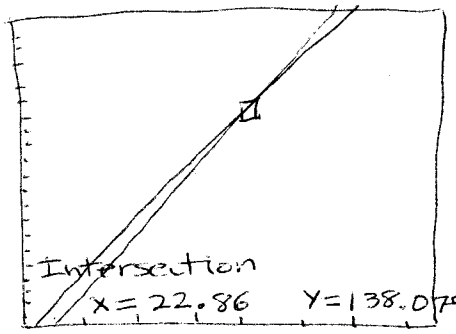
To calculate point of intersection

2nd TRACE = CALC

5. Intersect.

1st curve? ENTER
2nd curve? ENTER
Guess? (if more than one solution, use cursor) ENTER

} Y_3, Y_4 etc must be empty in your Y= menu



Look at bottom of screen for answer
22.866647

Solution $x \approx 22.8666$

So what is the y value? It's the y-coord we get by substituting back into LHS or RHS. This is an artifact of using this method. But we are still solving for x.

$2\pi x - 5.6 = 7(x - \pi)$

ycoord 138.075 = ycoord 138.075

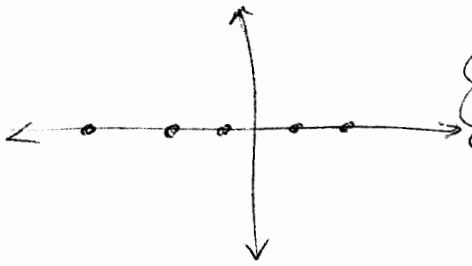
Math 70

X-intercept Method:

1) Solve the equation graphically. Round solution to the nearest ten-thousandth.

$2\pi x - 5.6 = 7(x - \pi)$

To use x-intercept method, remember:



All points on the x-axis have y-coordinate 0.

We need $y = 0$ in our equation.

Set equation $= 0$, with either the 0 on the LHS or the zero on the RHS:

$0 = 7(x-\pi) - 2\pi x + 5.6$ OR $2\pi x - 5.6 - 7(x-\pi) = 0$

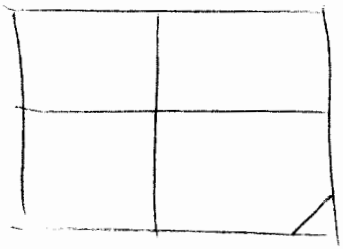
We will graph only one function. Must clear y_2.

[y=]

$y_1 = 7(x-\pi) - 2\pi x + 5.6$

$y_2 =$ [CLEAR]

[ZOOM] [6]

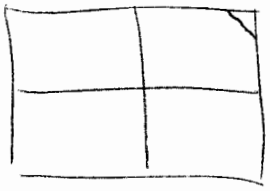


[y=]

$y_1 = 2\pi x - 5.6 - 7(x-\pi)$

$y_2 =$ [CLEAR]

[ZOOM] [6]

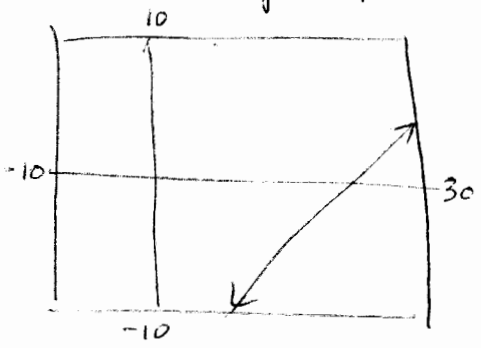


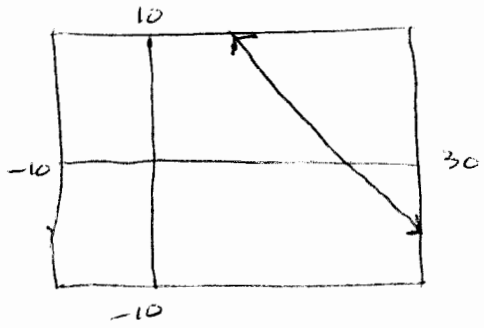
Adjust the window so that the x-intercept is visible $\Rightarrow$ increase XMAX

[WINDOW] XMAX = 30 (for example)

Math 70

X-intercept Method, cont.





To calculate x-intercept:

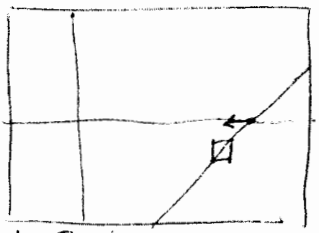
2nd [TRACE] = [CALC]

2. Zero

{ on 86 [GRAPH]-[MORE] MATH-ROOT F1 F1 }

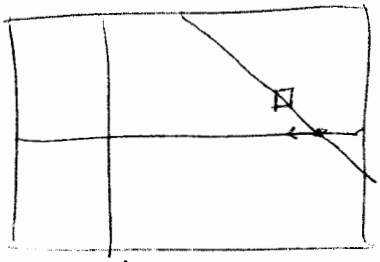
IMPORTANT: Do NOT press [ENTER] three times or the GC will give you a guaranteed error.

Left Bound? Must move cursor using ▶ or ◀ to a point on the line to the left of the x-intercept. (You're telling the GC where to look).



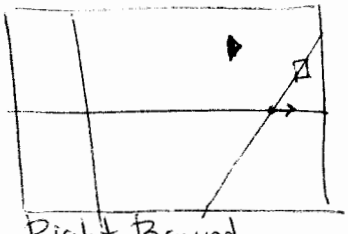
Left bound

[ENTER]

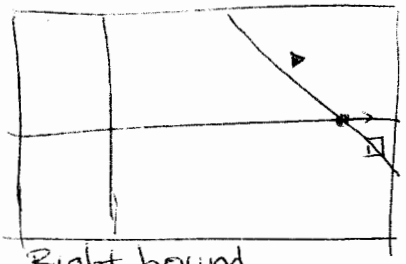


Left bound.

Right Bound? Must move cursor using ▶ to a point on the line to the right of the x-intercept.



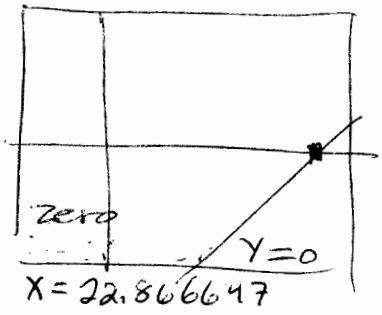
Right Bound

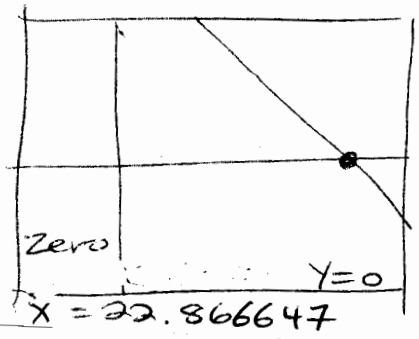


Right bound

Guess? [ENTER]

X-intercept method, cont.





$x \approx 22.8666$

Which method should you use?
Either method is valid.

	Intersection	X-intercept
Advantages	GC keystrokes easier No algebra to rearrange	Easier to adjust window (only XMIN or XMAX)
Disadvantages	Harder to adjust window	Algebra at beginning to set =0. GC keystrokes require cursor movement

Math 70 **Approximating the Solution(s) to an Equation Using the Graphing Calculator**

Intersection of Graphs Method:

1) Solve $2\pi x + 5.6 = 7(x - \pi)$ graphically using your graphing calculator.

(a) For this equation, what function(s) do you graph in your calculator?

$Y_1 = 2\pi x + 5.6$

$Y_2 = 7(x - \pi)$ ↙ or vice-versa

(b) For the method you chose, where/how do you find the solution(s)?

The x-coordinate of the point of intersection, or point where graphs intersect.

(c) Round the solution to four decimal places.

$x \approx 22.86664$

$\boxed{x \approx 22.8666}$

↑ tenths ↑ hundredths ↑ thousandths ↑ ten-thousandths

x-intercepts Method:

2) Solve $2\pi x + 5.6 = 7(x - \pi)$ graphically using your graphing calculator.

(a) For this equation, what function(s) do you graph in your calculator?

$Y_1 = 2\pi x + 5.6 - 7(x - \pi)$ ↙ or subtract LHS from RHS

(b) For the method you chose, where/how do you find the solution(s)?

The x-coordinate of the x-intercept or point where graph intersects the x-axis.

(c) Round the solution to four decimal places.

$x \approx 22.86664$

$\boxed{x \approx 22.8666}$

Math 72 3.1 Identities and Contradictions

Solve each equation and classify as conditional, identity or contradiction.

① $2(z-1)+z = 4z+2$

$2z-2+z = 4z+2$ distribute

$3z-2 = 4z+2$ combine like terms

$-2 = z+2$ subtract $3z$ both sides

"Solve": $\boxed{-4 = z}$ subtract 2 both sides

This equation is **conditional** (It is true on the condition that z is -4.)

② $2(z-1)+z = 3z+2$

$2z-2+z = 3z+2$

$3z-2 = 3z+2$

$-2 \neq 2$

"Solve": **no solution** No value of z makes this equation true.

This equation is a **contradiction.** All values of z contradict the truth.

③ $2(z-1)+z = 3z-2$

$2z-2+z = 3z-2$

$3z-2 = 3z-2$

$-2 = -2$

"Solve": **all real numbers are solutions** Any real value of z makes this equation true.

This equation is an **identity.** The left side has the same value or identity as the right side.