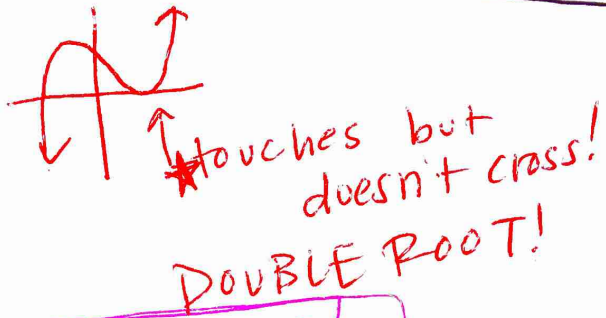


HM3 Finding Roots with the Calc: 22, 24, 25, 33, 35, 42, 43, 44

22) $x^3 - x^2 - 8x + 12 = 0$

3 roots
calc table: (-3, 0)
 (2, 0)



ROOTS: $x = -3, 2$ (multiplicity 2)

24) $x^3 + 9x^2 + 23x + 15 = 0$

3 roots
calc table: (-5, 0)
 (-3, 0)
 (-1, 0)



ROOTS: $x = -5, -3, -1$

25) $x^3 + x^2 - 2x - 2 = 0$

3 roots
calc table: (-1, 0)



*since the others weren't in the calc. table they must be IRRATIONAL

looks like a double root but if you zoom in you'll see that it does cross x-axis

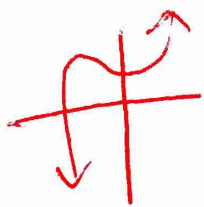
-1)	1	1	-2	-2
+ ↓	-1	0	2	
<hr/>				
	1	0	-2	0

$x^2 - 2 = 0$
 $x^2 = 2$
 $x = \pm\sqrt{2}$

ROOTS: $x = -1, \pm\sqrt{2}$

$$x^3 - 2x + 4 = 0$$

3 roots



* 2 roots will be IMAGINARY!

calc table: (-2, 0)

$$\begin{array}{r} -2 \overline{) 1 \quad 0 \quad -2 \quad 4} \\ + \downarrow \quad -2 \quad 4 \quad -4 \\ \hline \end{array}$$

$$1 \quad -2 \quad 2 \quad 0$$

$$x^2 - 2x + 2 = 0$$

$$x^2 - 2x + \underline{1} = -2 + \underline{1}$$

$$(x-1)^2 = -1$$

$$x-1 = \pm \sqrt{-1}$$

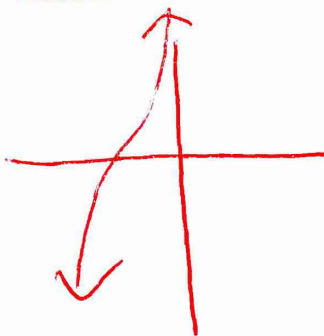
$$x = 1 \pm i$$

ROOTS:

$$x = -2, 1 \pm i$$

35) $x^3 + 6x^2 + 12x + 8 = 0$

3 roots



calc table: (-2, 0)

$$\begin{array}{r} -2 \overline{) 1 \quad 6 \quad 12 \quad 8} \\ + \downarrow \quad -2 \quad -8 \quad -8 \\ \hline \end{array}$$

$$1 \quad 4 \quad 4 \quad 0$$

$$x^2 + 4x + 4 = 0$$

$$(x+2)(x+2) = 0$$

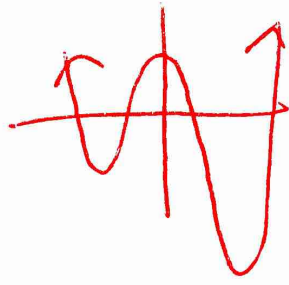
$$x = -2 \quad x = -2$$

ROOTS:

$$x = -2 \text{ (multiplicity 3)}$$

$$x^4 - x^3 - 11x^2 - 5x + 4 = 0$$

4 roots



Calc table: $(-1, 0)$
 $(4, 0)$

$$\begin{array}{r|rrrrr} -1 & 1 & -1 & -11 & -5 & 4 \\ + \downarrow & & -1 & 2 & 9 & -4 \\ \hline & 1 & -2 & -9 & 4 & 0 \end{array}$$

$$\begin{array}{r|rrrr} 4 & 1 & -2 & -9 & 4 \\ + \downarrow & & 4 & 8 & -4 \\ \hline & 1 & 2 & -1 & 0 \end{array}$$

$$x^2 + 2x - 1 = 0$$

$$x^2 + 2x + \underline{1} = 1 + \underline{1}$$

$$(x+1)^2 = 2$$

$$x+1 = \pm \sqrt{2}$$

$$x = -1 \pm \sqrt{2}$$

ROOTS:

$$x = -1, 4, -1 \pm \sqrt{2}$$

$$x^4 + 13x^2 + 36 = 0$$

4 roots

*all 4 are imaginary so
we can't use synthetic division...

JUST FACTOR IT!

$$x^4 + 13x^2 + 36 = 0$$

$$(x^2 + 9)(x^2 + 4) = 0$$

$$x^2 + 9 = 0$$

$$x^2 + 4 = 0$$

$$x^2 = -9$$

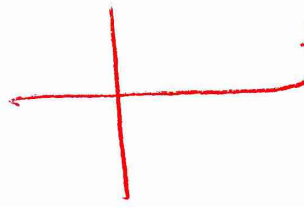
$$x^2 = -4$$

$$x = \pm 3i$$

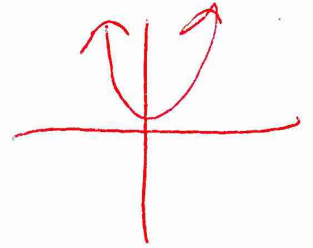
$$x = \pm 2i$$

Roots:

$$x = \pm 3i, \pm 2i$$

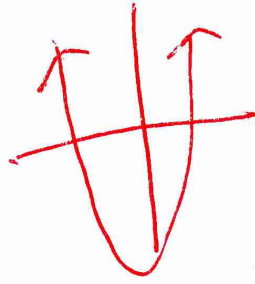


*you have to use
zoom fit to be
able to see this
graph!



$$\textcircled{1} x^4 + x^2 - 20 = 0$$

4 roots



calc table: $(-2, 0)$
 $(2, 0)$

$$\begin{array}{r} 2 \mid 1 \quad 0 \quad 1 \quad 0 \quad -20 \\ + \downarrow \quad 2 \quad 4 \quad 10 \quad 20 \\ \hline 1 \quad 2 \quad 5 \quad 10 \quad 0 \end{array}$$

$$\begin{array}{r} -2 \mid 1 \quad 2 \quad 5 \quad 10 \\ + \downarrow \quad -2 \quad 0 \quad -10 \\ \hline 1 \quad 0 \quad 5 \quad 0 \end{array}$$

$$x^2 + 5 = 0$$

$$x^2 = -5$$

$$x = \pm i\sqrt{5}$$

Roots:

$$x = 2, -2, \pm i\sqrt{5}$$