

① (5pts)

$$12x + 11 = 5x - 4$$

$$7x = -15$$

$$x = -\frac{15}{7}$$

$$\frac{5}{105} = \frac{1}{21}$$

$$\begin{array}{r} 3 \overline{)105} \\ 5 \overline{)35} \\ 7 \end{array}$$

$$\begin{array}{r} 3 \overline{)15} \\ 5 \overline{)7} \\ 105 \end{array}$$

② (5pts)

$$\frac{x}{10} + \frac{7}{6} = \frac{2}{15}x - \frac{5}{105}$$

2.5 3.2 3.5 3.7

$$\text{LCD} = 2 \cdot 3 \cdot 5 \cdot 7 = 210$$

$$\frac{x}{2.5} \cdot \frac{3.7}{3.7} + \frac{7}{3.2} \cdot \frac{5.7}{5.7} = \frac{2x}{3.5} \cdot \frac{2.7}{2.7} - \frac{1}{3.7} \cdot \frac{2.5}{2.5} \Rightarrow$$

$$\frac{21x + 245}{\text{LCD}} = \frac{28x - 10}{\text{LCD}} \Rightarrow$$

(5pts BONUS)

$$21x + 245 = 28x - 10$$

$$-7x = -255$$

$$x = -\frac{255}{-7} = \frac{255}{7} = x \approx 36.42857143$$

③ (5pts)

$$5(x+2)^2 = 7$$

$$(x+2)^2 = \frac{7}{5}$$

$$x+2 = \pm \sqrt{\frac{7}{5}} = \pm \frac{\sqrt{35}}{5}$$

$$x = -2 \pm \frac{\sqrt{35}}{5}$$

4 (5pts) $5x^2 - 4x + 11 = 0$

$$a=5, b=-4, c=11 \rightarrow b^2 - 4ac = (-4)^2 - 4(5)(11)$$

$$x = \frac{4 \pm 2i\sqrt{51}}{2(5)} = \boxed{\frac{2 \pm i\sqrt{51}}{5}} = x$$

$$= 16 - 220 = -204$$

$$\begin{array}{r} 2 \overline{)204} \\ 2 \overline{)102} \\ 3 \overline{)51} \\ 17 \end{array}$$

5 (5pts) $7x^2 = 5 \rightarrow$

$$7x^2 + 0x - 5 = 0 \rightarrow a=7, b=0, c=-5$$

$$\rightarrow b^2 - 4ac = 0^2 - 4(7)(-5) = \boxed{140} > 0$$

$$\begin{array}{r} 2 \overline{)140} \\ 2 \overline{)70} \\ 5 \overline{)35} \\ 7 \end{array}$$

\rightarrow 2 real, irrational solms

6 (5pts) $5x^2 - 4x + 11 = 0 \rightarrow b^2 - 4ac = \boxed{-204} < 0$

\rightarrow 2 nonreal solms

7 (5pts) $132x^2 - 29x - 28 = 0 \rightarrow a=132, b=-29, c=-28$

$$\rightarrow b^2 - 4ac = (-29)^2 - 4(132)(-28) = 841 + 14784$$

$$= \boxed{15625} = 125^2 > 0 \rightarrow$$

2 real (rational!) solms

8 5pts

$$x^2 + 2x - 224$$

$$= x^2 + 16x - 14x - 224$$

$$= x(x+16) - 14(x+16)$$

$$= (x+16)(x-14) = 0 \rightarrow$$

$$x \in \{-16, 14\}$$

16

2 | 224
 2 | 112
 2 | 56
 2 | 28
 2 | 14
 7

14

I just worked #7 3 ways!

9 5pts

$$132x^2 - 29x - 28 = 0$$

ONE AC METHOD

$$(132)(-28) = -3696$$

$$b = -29 = -39 + 10$$

$$-390$$

$$= -69 + 40$$

$$-2760$$

2nd AC METHOD

$$= -89 + 60$$

$$-5340$$

$$= -79 + 50$$

$$-3950$$

$$= -75 + 46$$

$$-3450$$

$$= -70 + 41$$

$$-2870$$

$$= -78 + 49$$

$$-3022$$

$$= -77 + 48$$

$$-3696$$

At last!
WRONG PROBLEM!

2 | 3696
 2 | 1848
 2 | 924
 2 | 462
 7 | 231
 3 | 33
 11

$$-77 + 48$$

$$132x^2 - 77x + 48x - 28 =$$

$$= 11x(12x - 7) + 4(12x - 7) =$$

$$= (12x - 7)(11x + 4) = 0 \rightarrow$$

$$x \in \left\{ -\frac{4}{11}, \frac{7}{12} \right\}$$

(11) With a sledgehammer 9

$$a = 132, b = -29, c = -28$$

$$b^2 - 4ac = (-29)^2 - 4(132)(-28) = 15625$$

$$\sqrt{15625} = 125 \quad 80$$

$$x = \frac{29 \pm 125}{2(132)} \rightarrow \frac{7}{12} \quad \downarrow \quad -\frac{4}{11}$$

Wrong
Problem.

$$\text{So } 132 \left(x - \frac{7}{12} \right) \left(x + \frac{4}{11} \right)$$

$$= (11)(12) \left(x - \frac{7}{12} \right) \left(x + \frac{4}{11} \right)$$

$$= (12) \left(x - \frac{7}{12} \right) (11) \left(x + \frac{4}{11} \right)$$

$$= (12x - 7)(11x + 4) \quad \text{is its factored form!}$$

$$x \in \left\{ \frac{7}{12}, -\frac{4}{11} \right\}$$

You can always engineer factored form

121

T1

(5)

Let's actually do #9! Factor out Greatest Common Factor

(9) (5pts) $60x^2 - 105x - 225 = 0$

MAGIC: $60(-225) = -13500$

want a difference

$-105 = -125 + 20$ -2500 of -105
 $= -225 + 120$ -27000 ugh!
 $= -175 + 70$ -12250
 $= -100 + 75$ -13500 !

2 | 13500
2 | 6750
3 | 3375
3 | 1125
3 | 375
5 | 125
5 | 25
5

$60x^2 - 180x + 75x - 225$

$= 60x(x-3) + 75(x-3)$

$= (x-3)(60x+75) = 0$

$\Rightarrow x \in \left\{ 3, -\frac{75}{60} \right\}$

$-\frac{75}{60} = -\frac{15}{12} = -\frac{5}{4}$

$15(4x^2 - 7x - 15)$

$= 4x^2 - 7x - 15 = 0$

$4x^2 - 12x + 5x - 15 = 0$

$4x(x-3) + 5(x-3) = 0$

$(x-3)(4x+5) = 0$

I finally notice the redundant factors

Factor out "15"!

$x \in \left\{ 3, -\frac{5}{4} \right\}$

is Much easier!
Factors of -60 whose sum is -7

2 | 60
2 | 30
3 | 15
5

$x \in \left\{ -\frac{5}{4}, 3 \right\}$

121

+1

(6)

(10) 5pts

$$x^2 + 2x - 224 =$$

$$= x^2 + 2x + 1^2 - 1 - 224$$

$$= (x+1)^2 - 225 \quad \text{SET } = 0 \quad \longrightarrow$$

$$(x+1)^2 = 225$$

$$x+1 = \pm \sqrt{225} = \pm 15$$

$$\begin{array}{r} 3 \overline{)225} \\ \underline{3 \ 75} \\ 5 \overline{)25} \\ \underline{5} \end{array}$$

$$\Rightarrow x = -1 \pm 15 \quad \begin{array}{l} \nearrow 14 \\ \searrow -16 \end{array}$$

$$x \in \{-16, 14\}$$

(11) 5pts

$$5x^2 - 3x - 10$$

$$= 5 \left(x^2 - \frac{3}{5}x \right) - 10$$

$$= 5 \left(x^2 - \frac{3}{5}x + \left(\frac{3}{10}\right)^2 \right) - 10 - 5 \left(\frac{9}{100}\right)$$

$$= 5 \left(x - \frac{3}{10} \right)^2 - \frac{209}{20} \quad \text{SET } = 0$$

$$-10 - \frac{9}{20}$$

$$= \frac{-200 - 9}{20} = \frac{-209}{20}$$

$$\Rightarrow 5 \left(x - \frac{3}{10} \right)^2 = \frac{209}{20}$$

$$\left(x - \frac{3}{10} \right)^2 = \frac{209}{100} \quad \longrightarrow x =$$

$$\frac{3 \pm \sqrt{209}}{10} = x$$

121

T1

(12) (a) (Spts) $(x_1, y_1) = (2, -3), (x_2, y_2) = (-7, -12)$

$$\Rightarrow m = \frac{y_2 - y_1}{x_2 - x_1} = \frac{-12 - (-3)}{-7 - 2} = \frac{-12 + 3}{-9} = \frac{-9}{-9} = 1$$

$$y = m(x - x_1) + y_1$$

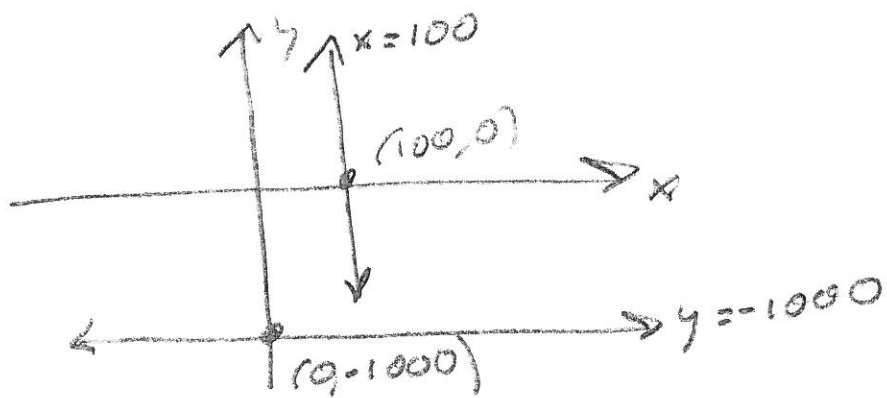
$$\boxed{y = 1(x - 2) - 3} = x - 5 = y$$

(b) (Spts) $m = \frac{1}{3} \Rightarrow m_{\perp} = -3$ & $(x_1, y_1) = (7, -3)$

$$\Rightarrow y = m_{\perp}(x - x_1) + y_1 = \boxed{-3(x - 7) - 3 = y} \text{ STOP}$$

$$= -3x + 21 - 3 = -3x + 18 = y$$

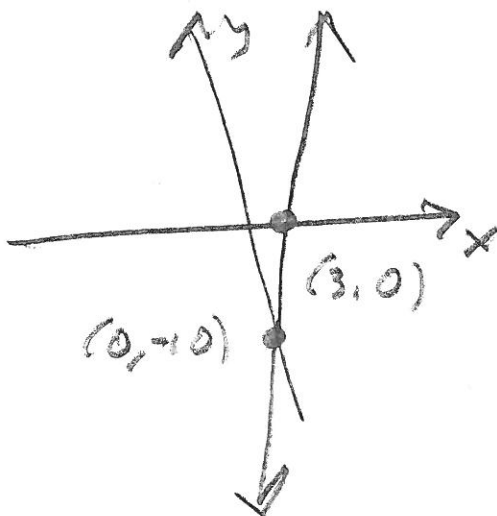
(13) (a) (Spts) $x = 100$ (b) (Spts) $y = -1000$



14) 5pts

$$10x - 3y = 30$$

x	y
0	-10
3	0



15) 5pts

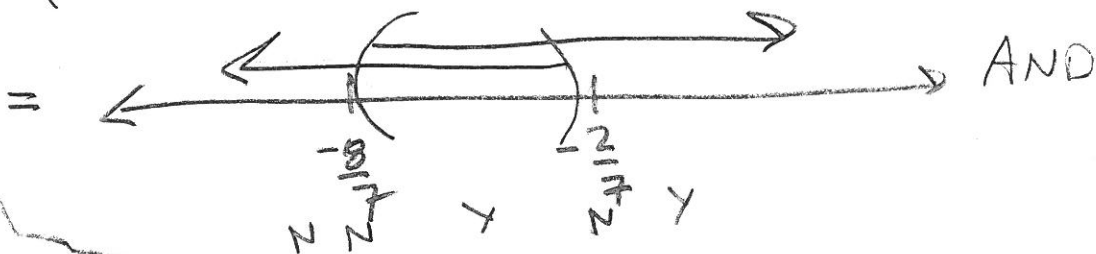
$$17x + 5 < 3$$

$$\Rightarrow 7x + 5 < 3 \quad \text{AND} \quad 7x + 5 > -3$$

$$7x < -2$$

$$7x > -8$$

$$\left\{ x \mid x < -\frac{2}{7} \quad \text{AND} \quad x > -\frac{8}{7} \right\}$$



$$= \left(-\frac{8}{7}, -\frac{2}{7} \right)$$

12.1

T1

9

15b 5pts

M1

$$|-3x+11| \geq 3$$

$$|ab| = |a||b|$$

$$|-3x+11| = |-1(3x-11)| = |-1||3x-11| =$$

$$M2: |-3x+11| = |3x-11|$$

$$-3x+11 \geq 3 \text{ OR } -3x+11 \leq -3$$

$$-3x \geq -8 \text{ OR } -3x \leq -14$$

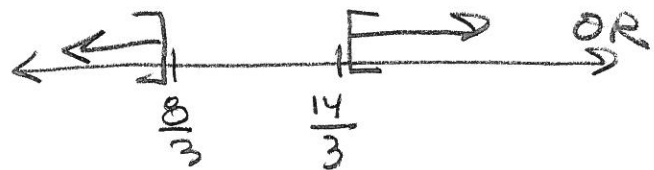
$$x \leq \frac{-8}{-3} \text{ OR } x \geq \frac{-14}{-3}$$

$$\rightarrow 3x-11 \geq 3 \text{ OR } 3x-11 \leq -3$$

$$3x \geq 14 \text{ OR } 3x \leq 8$$

$$\left\{ x \mid x \geq \frac{14}{3} \text{ OR } x \leq \frac{8}{3} \right\}$$

$$\left\{ x \mid x \leq \frac{8}{3} \text{ OR } x \geq \frac{14}{3} \right\} =$$



$$= (-\infty, \frac{8}{3}] \cup [\frac{14}{3}, \infty)$$

SAME AS M1

15c 5pts $|8x+4|+5 < 4$

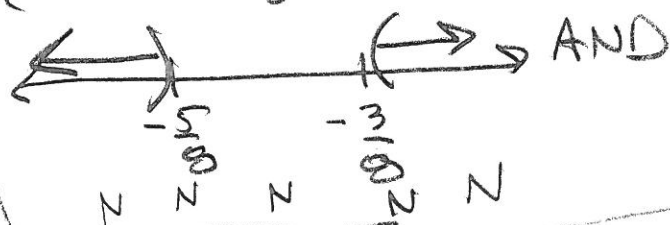
$$|8x+4| < -1 \rightarrow \emptyset \text{ DONE}$$

If you can't see it, then...

$$8x+4 < -1 \text{ and } 8x+4 > 1$$

$$8x < -5 \text{ and } 8x > -3$$

$$\left\{ x \mid x < -\frac{5}{8} \text{ and } x > -\frac{3}{8} \right\} =$$



$$= \emptyset$$

121

T1

10

15d) SptB $|8x + 4| - 5 \geq 3$

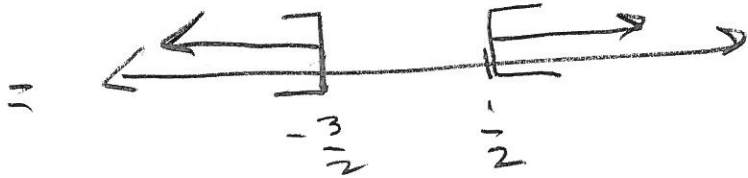
$$|8x + 4| \geq 8$$

$$8x + 4 \geq 8 \quad \text{OR} \quad 8x + 4 \leq -8$$

$$8x \geq 4 \quad \text{OR} \quad 8x \leq -12$$

$$x \geq \frac{4}{8} \quad \text{OR} \quad x \leq -\frac{12}{8}$$

$$\left\{ x \mid x \geq \frac{1}{2} \quad \text{OR} \quad x \leq -\frac{3}{2} \right\}$$



$$= (-\infty, -\frac{3}{2}] \cup [\frac{1}{2}, \infty)$$

16) SptB

Let $x = \#$ of nickels

$y = \#$ of quarters.

Then $x + y = 19$ and

$$.05x + .25y = 2.35$$

17) SptB

Let $x = \#$ of hours it takes

John & Tracy to mow the cemetery.

John alone: 30 hrs, Tracy Alone: 26 hrs.

$$\Rightarrow \frac{1}{30}x + \frac{1}{26}x = 1 \text{ job done}$$

12.1

T1

(11)

B1 5pts

$$\frac{1}{30}x + \frac{1}{26}x = 1$$

$$\frac{x}{30} + \frac{x}{26} = 1$$

$$\begin{array}{r} 2 \overline{)30} \\ 3 \overline{)15} \\ \hline 5 \end{array} \quad \begin{array}{r} 2 \overline{)26} \\ \hline 13 \end{array}$$

$$LCD = 2 \cdot 3 \cdot 5 \cdot 13 = 10 \cdot 39 = 390$$

$$\frac{x}{2 \cdot 3 \cdot 5} \cdot \frac{13}{13} + \frac{x}{2 \cdot 13} \cdot \frac{5 \cdot 3}{5 \cdot 3} = 1 = \frac{LCD}{LCD}$$

$$\frac{13x + 15x}{LCD} = \frac{390}{LCD}$$

$$28x = 390$$

$$x = \frac{390}{28} = \frac{195}{14} = x$$

$$= \frac{182 + 13}{14} = 13 + \frac{13}{14}$$

B2 5pts

John shows up 2 hrs late.

Let $x = \#$ of hours John works.Then $x+2 = \#$ of hours Tracy works, and

$$\frac{1}{30}x + \frac{1}{26}(x+2) = 1$$

An equivalent setup:

Let $x = \#$ of hours Tracy works. Then $x-2 = \#$ of hours John works, and

$$\frac{1}{30}(x-2) + \frac{1}{26}x = 1 \implies$$

$$\frac{13(x-2) + 15x}{LCD} = \frac{13x - 26 + 15x}{LCD} = \frac{LCD}{LCD}, \quad \beta$$

$$28x - 26 = 390$$

$$28x = 416$$

$$x = \frac{416}{28} = \frac{104}{7} = x$$

$$\implies x-2 = \frac{104}{7} - \frac{14}{7} = \frac{90}{7} = x-2$$

12.1

T1

(12)

(B3) $y = 11x + 5$

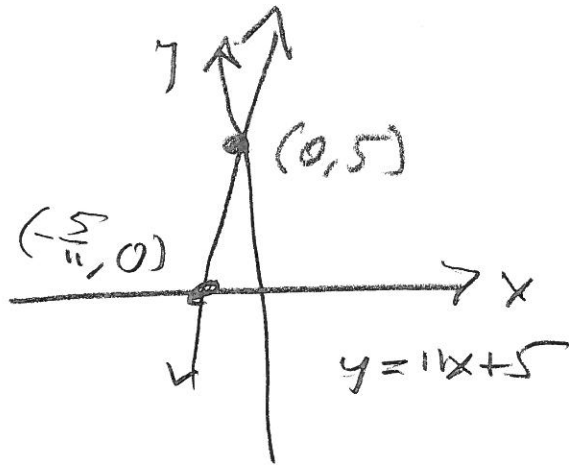
x	y
0	5
$-\frac{5}{11}$	0

SptB

$$11x + 5 = 0$$

$$11x = -5$$

$$x = -\frac{5}{11}$$



(B4) SptB (5ptB) $f(x) = x^2 + 2x - 224$

$$= x^2 + 2x + 1^2 - 1 - 224 = (x+1)^2 - 225 = f(x)$$

(B5) SptB $x^4 - 81 = (x^2)^2 - 9^2$

$$= (x^2 - 9)(x^2 + 9)$$

$$= (x-3)(x+3)(x-3i)(x+3i)$$