

Final Review B: CMP 0809

Solutions

1. $y = x^2 - 2x - 3$

a. x-int: $0 = x^2 - 2x - 3$

$$0 = (x-3)(x+1)$$

x-int: $(3,0) (-1,0)$

y-int: $y = 0^2 - 2(0) - 3$

$$y = -3$$

y-int: $(0,-3)$

b. line of sym between x-int

so $x=1$

Vertex solution

$$y = x^2 - 2x - 3$$

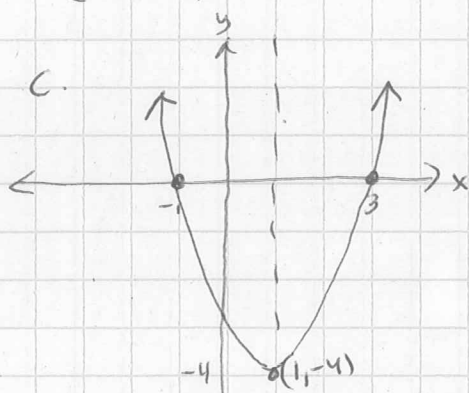
$$y = (1)^2 - 2(1) - 3$$

$$y = 1 - 2 - 3$$

$$y = -4$$

vertex $1, -4$

[open up]



2. $P = -90h + 495$

a. (Truck unloaded when $P=0$)

$$0 = -90h + 495$$

$$\begin{array}{r} -495 \\ -90h + 495 \\ \hline -495 \end{array}$$

$$-495 = -90h$$

$$\begin{array}{r} -90 \\ -495 = -90h \\ \hline 5.5 \end{array}$$

$5.5 = h$ 5.5 hours to unload

2b. pumpkins to start with (when $h=0$)

$$P = -90h + 495$$

$$P = -90(0) + 495$$

$P =$ 495 pumpkins to start

c. Factored form:

$$P = -45(2h - 11)$$

d. Pumpkins unloaded each hour is the rate of Δ

$$P = -90h + 495$$

↑ slope or rate of change

90 pumpkins unloaded each hour

3. Simplify

$$5x^2 - 3x + 8 - (2x^2 - 4x + 9)$$

[be sure you subtract all 3 terms]

$$5x^2 - 3x + 8 - 2x^2 + 4x - 9$$

$3x^2 + x - 1$

4. Solve for x & graph:

$$-20x - 11 \geq 14 + 15x$$

$$\begin{array}{r} -20x - 11 \geq 14 + 15x \\ +20x \qquad \qquad \qquad +20x \end{array}$$

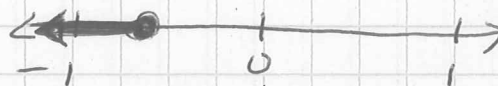
$$-11 \geq 14 + 35x$$

$$\begin{array}{r} -11 \geq 14 + 35x \\ -14 \qquad -14 \end{array}$$

$$\begin{array}{r} -25 \geq 35x \\ 35 \qquad \qquad 35 \end{array}$$

$$\frac{-25}{35} \geq x \quad \text{OR}$$

$$x \leq -\frac{5}{7}$$



5.	hrs	dose
+1	< 1	90
	2	85

$\times .94$

decay factor (multiplier!) is $.94$

decay rate (how fast is it disappearing?) is 5.6%

Equation

$$y = \frac{a}{b} \cdot b^x$$

starting amt multiplier

x	y
0	95.3
1	90
2	85

going backwards divide by $.94$

$\times .94$

$$y = 95.3(.94)^x$$

6. a. $(-4x^3y)^2 (2y^2)$

$$(16x^6y^2)(2y^2)$$

$$32x^6y^4$$

b. $\frac{16x^{-3}y^7}{32x^5y^3} =$

$$\frac{16y^7}{32 \cdot x^5 \cdot x^3 \cdot y^3} = \frac{y^4}{2x^8}$$

c. $(2^{-3})(4^0)(2^4)$

$$\left(\frac{1}{8}\right)(1)(16) = 2$$

7. Solve $2x^2 - x = 15$

$$\begin{array}{r} 2x^2 - x - 15 = 0 \end{array}$$

Quad Equation must be in std. form before factoring or "formulating"

$$(2x+5)(x-3) = 0$$

$$x = -\frac{5}{2} \quad x = 3$$

you could use formula here but it's slower!!

8. Solve for w in terms of x + y

$$6y - 4w = 3x$$

$$\begin{array}{r} -6y \\ \hline -4w = 3x - 6y \end{array}$$

$$\frac{-4w}{-4} = \frac{3x - 6y}{-4}$$

$$w = -\frac{3}{4}x + \frac{6}{4}y$$

$$w = -\frac{3}{4}x + \frac{3}{2}y$$

9. $4.67 \times 10^{-4} = .000467$

$$67,800,000 = 6.78 \times 10^7$$

cans collected to recycle # people fine

10. $N = 2.5(P - 40) - 100$

$$N = 2.5P - 100 - 100$$

$$N = 2.5P - 200$$

a. linear equation of form $y = mx + b$

b. 400 people attend:

$$N = 2.5P - 200$$

$$N = 2.5(400) - 200$$

$$N = 1000 - 200$$

$$N = 800 \text{ cans collected}$$

c. 300 cans:

$$N = 2.5P - 200$$

$$300 = 2.5P - 200$$

$$+200 \quad +200$$

$$\frac{500}{2.5} = \frac{2.5P}{2.5}$$

$$P = 200 \text{ people attended}$$

11.

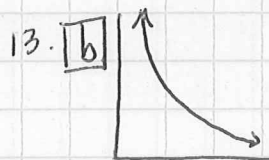
Layer	# of cans in layer
1	3
2	6
3	9

↑ Linear

- a. Layer 12 → 36 cans
 b. LINEAR C = 3L

12. $y = -5x + 6$

parallel: $y = -5x + (\text{anything})$
 perpendicular $y = \frac{1}{5}x + (\text{anything})$



← inverse variation graph
 $y = \frac{k}{x}$

As x doubles, y halves
 As x halves, y doubles
 neither x nor y can ever be zero

14. # folds | Area

a.

0	1
1	$\frac{1}{3}$
2	$\frac{1}{9}$
3	$\frac{1}{27}$
⋮	⋮

b. Pattern:

- Exponential decay (repeated mult. by $\frac{1}{3}$)
- decreasing at a decreasing rate
- as x ↑ by 1, y mult by $\frac{1}{3}$

c. Equation: $y = \left(\frac{1}{3}\right)^x$

15. Evaluate $6x^2 + 13$ $x = -10$

$$6(-10)^2 + 13$$

$$6(100) + 13$$

$$600 + 13$$

613

16. $5x^2 + x - 20$ $x = 10$

$$5(10)^2 + 10 - 20$$

$$5(100) + 10 - 20$$

$$500 + 10 - 20$$

$$600 - 20$$

40

17. $x + y = 10$ $x + y = 10$
 $-1(2x + y) = (12) - 1 \quad -2x - y = -12$
 $(-1) - x = -2(-1)$
 $x = 2$
 $x + y = 10$
 $2 + y = 10$
 $y = 8$
(2, 8)

18. 2 Expressions Equivalent to
 $x(5-6) + 13x - 10$
 $(5x - 6x + 13x - 10) \leftarrow \#1$
 $-x + 13x - 10$
 $12x - 10$ $\leftarrow \#2$
 (various answers)

19.

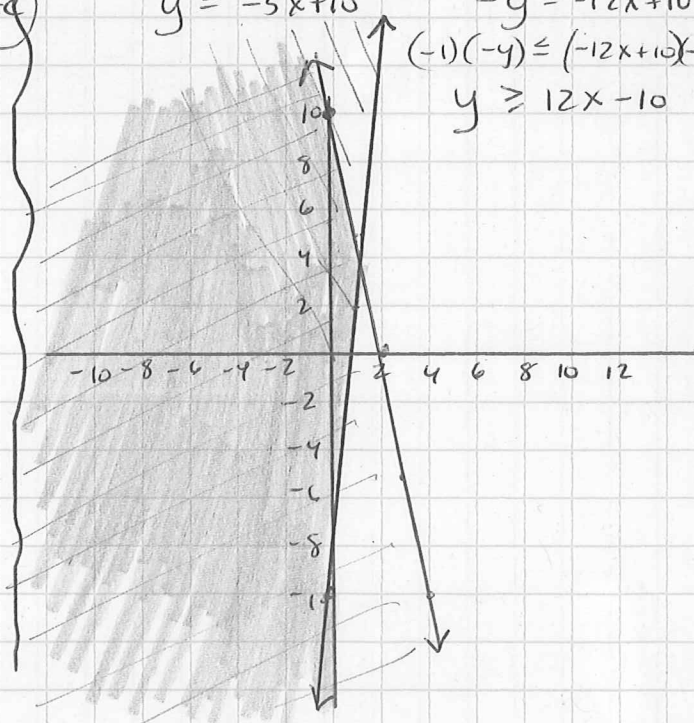
x	y
0	1
1	1.2
2	1.44
3	1.728
4	2.0736
5	2.48832

b. $y = (1.2)^x$

c. growth factor is 1.2

d. growth rate is 20%

20. $5x + y \leq 10$ $12x - y \leq 10$
 $-5x \quad -5x \quad -12x \quad -12x$
 $y \leq -5x + 10$ $-y \leq -12x + 10$
 $(-1)(-y) \leq (-12x + 10)(-1)$
 $y \geq 12x - 10$



21. \overline{AB}

$$6^2 + 8^2 = c^2$$

$$36 + 64 = c^2$$

$$100 = c^2$$

$$10 = c$$

a. $\overline{AB} = 10 \text{ units}$

\overline{CD}

$$3^2 + 5^2 = c^2$$

$$9 + 25 = c^2$$

$$34 = c^2$$

$$\sqrt{34} = c$$

b. $\sqrt{34} \text{ units} = \overline{CD}$

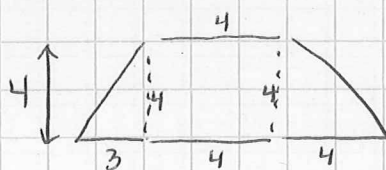
22.

x	y
-1	-5
0	0
1	3
2	4
3	3
4	0
5	-5

a. Describe Pattern:
As $x \uparrow$ by one, the Δy decreases by 2.
This results in a parabola. Between $x = -1$ and $x = 2$, y is increasing at a decreasing rate. Thereafter y decreases at an increasing rate.

b. Quadratic:
2nd differences on table are the same

23. Perimeter



Lengths:
Bottom 11
Top 4
Left side 5
Rightside 5.7

Left:

$$3^2 + 4^2 = c^2$$

$$9 + 16 = c^2$$

$$25 = c^2$$

$$5 = c$$

Right:

$$4^2 + 4^2 = c^2$$

$$16 + 16 = c^2$$

$$32 = c^2$$

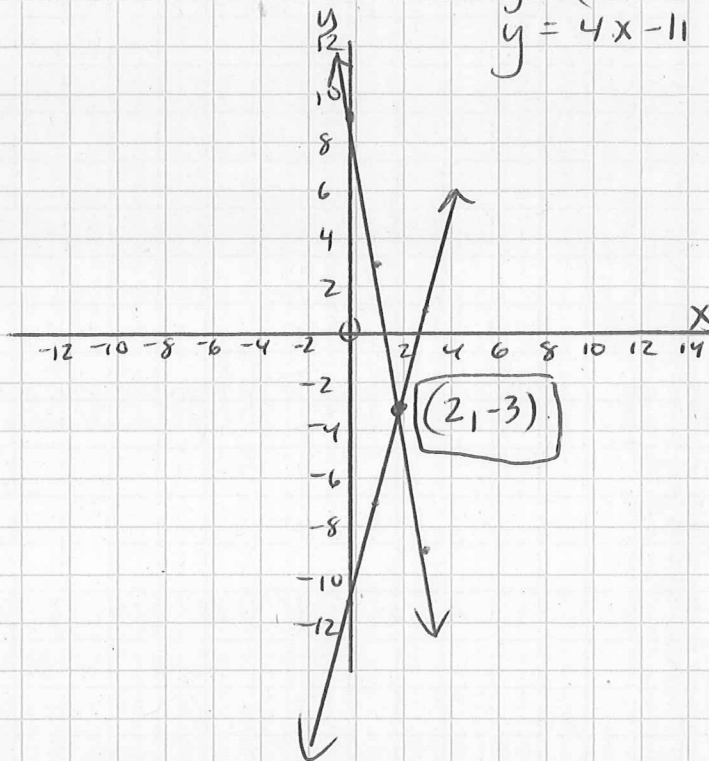
$$5.7 = c$$

Perim: 25.7 cm

24. slopes $a: \frac{1}{2}$ $b: -\frac{1}{3}$
 $c: \frac{3}{2}$ $d: -1$

25. $6x + y = 9$
 $-6x$ $-6x$
 $y = -6x + 9$

$4x - y = 11$
 $-4x$ $-4x$
 $-y = -4x + 11$
 $(-1) - y = (-4x + 11) - 1$
 $y = 4x - 11$



CHECK $6x + y = 9$
 $6(2) + (-3) = 9$
 $12 - 3 = 9$
 $9 = 9 \checkmark$

$4x - y = 11$
 $4(2) - (-3) = 11$
 $8 + 3 = 11$
 $11 = 11 \checkmark$

26. a. $x - 2y \geq 4$ b. $y - 2x \geq 4$ c. $2x + y \leq 4$
 $y \leq \frac{1}{2}x - 2$ (viii) $y \geq 2x + 4$ (vii) $y \leq -2x + 4$ (vi)
d. $x + 2y \leq 4$ e. $y \geq -2x$ f. $y \leq -2x$
 $y \leq -\frac{1}{2}x + 2$ (ii) (iii) (ix)
g. $x \geq -2$ h. $y \geq -2$ i. $-2 < x$
(i) (iv) (v)

27. a. $7 = \sqrt{49}$ True
b. $7 = -\sqrt{49}$ false
c. $-7 = \sqrt{49}$ false
d. $-7 = -\sqrt{49}$ True

28. Write linear equation thru

a. $(0,8)$ $(4,13)$
 \uparrow y-int. given!

x	y
0	8
4	13

 $\Delta y = 5$
 $\Delta x = 4 = m$

$$y = mx + b$$

$$y = \frac{5}{4}x + 8$$

b. Slope -3 thru $(1,4)$

$$y = mx + b$$

$$4 = -3(1) + b$$

$$4 = -3 + b$$

$$\begin{array}{r} +3 \quad +3 \\ 7 = b \end{array}$$

$$y = -3x + 7$$

c. Thru $(1,1)$ $(3,9)$

x	y
1	1
3	9

 $\Delta y = 8$
 $\Delta x = 2$
 $= 4 = m$

$$y = mx + b$$

$$9 = 4(3) + b$$

$$9 = 12 + b$$

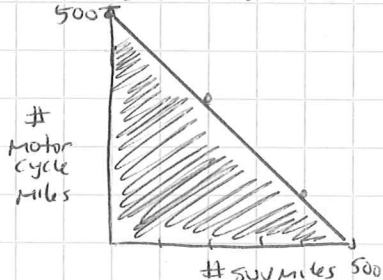
$$\begin{array}{r} -12 \quad -12 \\ -3 = b \end{array}$$

$$y = 4x - 3$$

29. $S = \# \text{ miles SUV drives}$

$M = \# \text{ miles motorcycle drives}$

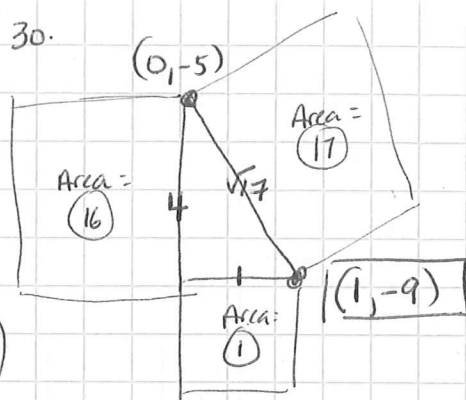
Limit total miles to 500 : $S + M \leq 500$



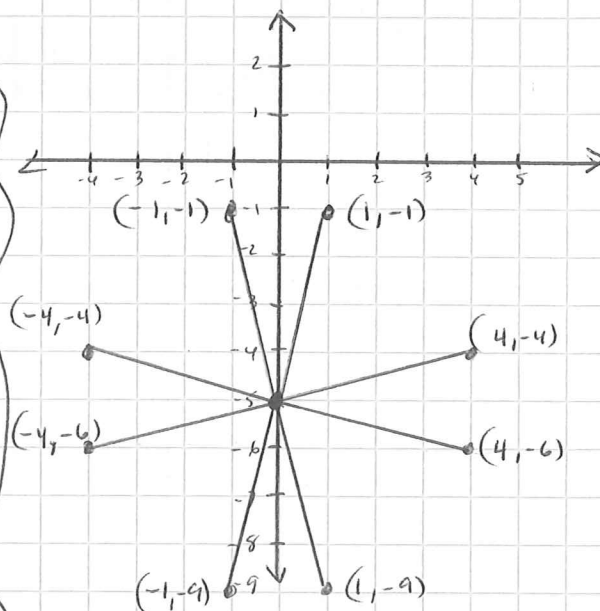
S	M
0	500
200	300
400	100
500	0

Simple solutions for exactly 500

30.



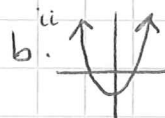
Other possible answers: (legs must be 1+4)



$$31. x^2 + 12x + 36 = (x+6)(x+6)$$

	x	6
x	x^2	$6x$
6	$6x$	36

32. a. Graph ii + iii are quadratic - they are parabolas



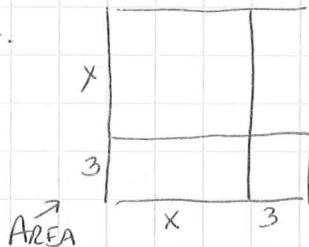
$$y = ax^2 + bx + c$$

\uparrow
Must be pos
(opens up)

\uparrow
Must be neg y-int
looks like
 $(0, -9)$

33. $q = 72r^2 - 24r$ (expanded)
 $q = 24r(3r - 1)$ (factored)
 ↑ GCF

34.



Factored: $(3+x)(3+x)$ or $(x+3)(x+3)$
 Expanded: $x^2 + 6x + 9$

35. $2(3x - 5y) = (7)2$
 $6x + 10y = 10$

$6x - 10y = 14$
 $6x + 10y = 10$
 $\frac{12x}{12} = \frac{24}{12}$

$x = 2$
 $(2, -\frac{1}{5})$

$3x - 5y = 7$
 $3(2) - 5y = 7$
 $6 - 5y = 7$
 $-5y = 1$
 $y = -\frac{1}{5}$

CHECK:

$3x - 5y = 7$
 $3(2) - 5(-\frac{1}{5}) = 7$
 $6 + 1 = 7$
 $7 = 7 \checkmark$
 $6x + 10y = 10$
 $6(2) + 10(-\frac{1}{5}) = 10$
 $12 - 2 = 10$
 $10 = 10 \checkmark$

36. $x \ y$
 $0 \ \frac{1}{16} > \times 4$
 $1 \ \frac{1}{4} > \times 4$
 $2 \ 1 > \times 4$
 $3 \ 4 > \times 4$
 $4 \ 16$
 $5 \ 64$

Exponential Growth:
 (constant multiplier -
 or factor - greater
 than 1)
 $y = \frac{1}{16}(4)^x$
 or $y = 4^{(x-2)}$

37. (n)

Cost	Price/Meal	Income
0	15.00	0
1	14.90	14.90
2	14.80	29.60
3	14.70	44.10
4	14.60	58.40

Price/meal is
 $15 - .10n$

38. $y \ w$
 2000 → $y \ R$ Whales

0	5000
1	4500
2	4050
3	3645
4	:
5	:
6	2657
7	2391
8	2152
9	1937

a. $W = 5000(.9)^y$
 b. decay factor = $.9$
 $\frac{4500}{5000} = \frac{4050}{4500} = \frac{y}{y_1}$

c. 2007:
 $2657(.9) = 2391$
 Whales

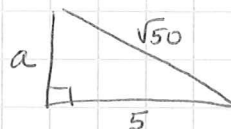
d. 2009 pop is below 2000 whales

39. $4x + 19 = 26 - 3x$
 $+ 3x$
 $7x + 19 = 26$
 $-19 -19$
 $\frac{7x}{7} = \frac{7}{7}$
 $x = 1$

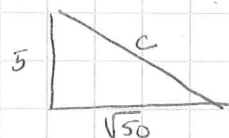
CHECK
 $4x + 19 = 26 - 3x$
 $4(1) + 19 = 26 - 3(1)$
 $4 + 19 = 26 - 3$
 $23 = 23 \checkmark$

40. Quadratic functions (equations):
 a, c, d, h

41.



$a^2 + b^2 = c^2$
 $a^2 + 5^2 = (\sqrt{50})^2$
 $a^2 + 25 = 50$
 $-25 -25$
 $a^2 = 25$
 $a = 5$ OR



$a^2 + b^2 = c^2$
 $5^2 + (\sqrt{50})^2 = c^2$
 $25 + 50 = c^2$
 $75 = c^2$
 $\sqrt{75} = c$

42.

X	Y
0	1
1	6
2	36
3	216
4	1296

a. $\boxed{5 \quad 7776}$

b. $\boxed{y = 6^x}$

c. Growth Factor is $\boxed{6}$

$\frac{6}{1} \quad \frac{36}{6} \quad \frac{216}{36} \text{ etc.}$

SUBSTITUTION

43. $2x + 10y = 36 \quad y = x + 12$

$2x + 10(x + 12) = 36$

$2x + 10x + 120 = 36$

$12x + 120 = 36$

$-120 \quad -120$

$\frac{12x}{12} = \frac{-84}{12}$

$x = -7$

$y = x + 12$

$y = -7 + 12$

$y = 5$

CHECK

$y = x + 12$

$5 = -7 + 12$

$5 = 5 \checkmark$

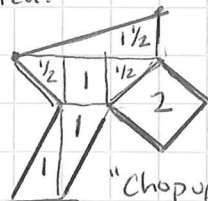
$2x + 10y = 36$

$2(-7) + 10(5) = 36$

$-14 + 50 = 36$

$36 = 36 \checkmark$

Area:



"Chop up
+ add"
strategy

Total Area

$\boxed{7\frac{1}{2} \text{ Units}^2}$

45.

# students	\$ Cost
10 < 0	450
10 < 10	600
10 < 20	750
20 < 40	1050

rate of $\frac{\Delta y}{\Delta x} = \frac{150}{10} = \frac{\$15}{1 \text{ student}}$

a. $\boxed{C = 15x + 450}$

b. # students if \$ is 690

$C = 15x + 450$

$690 = 15x + 450$

$-450 \quad -450$

$\frac{240}{15} = \frac{15x}{15}$

$\boxed{16 \text{ students} = x}$

c. 12 students \rightarrow ?? \$

$C = 15x + 450$

$C = 15(12) + 450$

$C = 180 + 450$

$\boxed{C = \$630}$

d. Op. Cost "at most" \$1000 (1000 or less!)

$\text{Costs} \leq 1000$

$15x + 450 \leq 1000$

$-450 \quad -450$

$\frac{15x}{15} \leq \frac{550}{15}$

$x \leq 36\frac{2}{3}$

less than 37 students

or $\boxed{36 \text{ students or fewer}}$

46 (skip)

47. $h = t(50 - 3t)$
 height of rocket (meters)
 time in sec.

a. How high after 5 sec?

$$\begin{aligned} h &= t(50 - 3t) \\ h &= 5(50 - 3(5)) \\ h &= 5(50 - 15) \\ h &= 5(35) \\ h &= \boxed{175 \text{ meters}} \end{aligned}$$

b. What is time when rocket is 200 m.

$$\begin{aligned} h &= t(50 - 3t) \\ 200 &= t(50 - 3t) \\ 200 &= 50t - 3t^2 \leftarrow \text{QUADRATIC!} \\ +3t^2 \quad +3t^2 \\ \hline 3t^2 + 200 &= 50t \\ -50t \quad -50t \\ \hline 3t^2 - 50t + 200 &= 0 \\ (3t - 20)(t - 10) &= 0 \leftarrow \text{FACTOR} \\ 3t - 20 &= 0 \\ +20 +20 \\ \hline 3t &= 20 \\ \frac{3t}{3} &= \frac{20}{3} \\ \boxed{t = 6.7 \text{ sec} \quad t = 10 \text{ sec.}} \end{aligned}$$

↑ 2 times (on way up + on way down)

48. $E = 200 + 11x$
 expenses
 # videos
 income
 $I = 120 + x^2$

a. Profit = Income - Expenses
 $P = 120 + x^2 - (200 + 11x)$
 $P = 120 + x^2 - 200 - 11x$
 $\boxed{P = x^2 - 11x - 80}$

b. Break even where Profit = 0!

$$\begin{aligned} 0 &= x^2 - 11x - 80 \leftarrow \text{Quadratic!} \\ 0 &= (x - 16)(x + 5) \\ \boxed{x = 16 \text{ videos}} \\ x = -5 &\leftarrow \text{not possible to sell neg videos} \end{aligned}$$

48c. \$100 Profit \Rightarrow
 $P = x^2 - 11x - 80$
 $100 = x^2 - 11x - 80$
 $-100 \quad -100$
 $0 = x^2 - 11x - 180$
 $0 = (x - 20)(x + 9)$
 $\boxed{x = 20 \text{ videos}}$
 $x = -9 \leftarrow \text{not possible}$

49. $2 > +4$
 $6 > +6$
 $12 > +8$
 $20 > +10$
 $30 > +10$

a. Increase is increasing by 2 each time (Quadratic Pattern)

b. Next 3 #s $\boxed{42, 56, 72}$

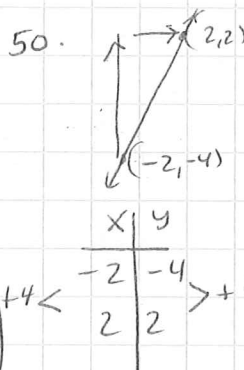
c.

n	number
1	2
2	6
3	12
4	20

n^{th} # is always

$$\boxed{n(n+1)}$$

$$\boxed{y = x(x+1)}$$



$$\frac{\Delta y}{\Delta x} = \frac{6}{4} \text{ or } \frac{3}{2}$$

y-int on graph (0, -1)

$$\boxed{y = \frac{3}{2}x - 1}$$

51. 20 students. All 20 students play all 19 others but this double counts so # games is $\frac{20(19)}{2} = \boxed{190}$

52. $2x + 4y = 14$
 $-2x \quad -2x$
 $\frac{4y}{4} = \frac{-2x + 14}{4}$
 $y = -\frac{1}{2}x + \frac{7}{2}$
 $x - 15y = 45$
 $-x \quad -x$
 $\frac{-15y}{-15} = \frac{-x + 45}{-15}$
 $y = \frac{1}{15}x - 3$
 $\boxed{y = -\frac{1}{2}x + \frac{7}{2} \quad y = \frac{1}{15}x - 3}$
 m b
 m b