

Midterm Review Problems A – Solutions

1. B
2. D
3. C
4. D
5. D
6. C
7. C
8. B
9. B
10. D
11. C
12. A
13. A
14. B
15. A
16. B
17. C
18. A
19. D
20. A
21. D
22. C
23. D
24. B
25. B
26. A
27. C
28. C
29. D
30. C
31. D
32. B
33. B
34. D

35. B
36. A
37. C
38. A
39. C
40. A
41. D
42. C
43. C
44. C
45. C
46. B
47. B
48. C
49. D
50. D
51. B
52. C
53. D
54. B
55. B
56. B
57. D
58. C
59. D
60. B
61. A
62. A
63. B
64. B
65. C
66. B
67. D

Midterm Review Problems B – 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

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

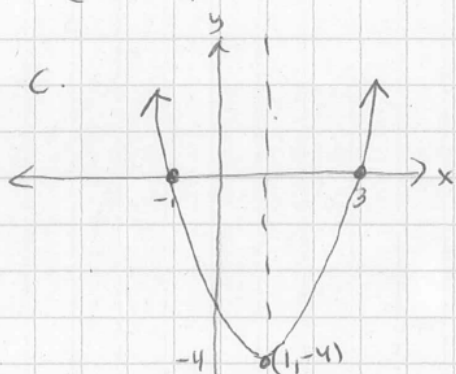
$$y = (1)^2 - 2(1) - 3$$

$$y = 1 - 2 - 3$$

$$y = -4$$

vertex $1, -4$

[open up]



2. $P = -90h + 495$

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

$$0 = -90h + 495$$

$$\frac{-495}{-90} = \frac{-495}{-90}$$

$$\frac{-495}{-90} = \frac{-90h}{-90}$$

$5.5 = h$ [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:

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

$$+ 20x \qquad + 20x$$

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

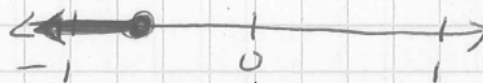
$$-14 \quad -14$$

$$\frac{-25}{35} \geq \frac{35x}{35}$$

$$\frac{-25}{35} \geq x$$

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

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



5.	hours	dose
+1	< 1 90 2 85 >	$\times .94$

decay factor (multiplier) is $.94$

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

Equation

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

starting amt multiplier

X	y
0	95.3
1	90
2	85

going backwards divide by $.94$

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

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

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

$$32x^6y^4$$

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

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

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

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

$$7. \text{ Solve } 2x^2 - x = 15$$

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

Quadratic 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

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

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

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

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

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

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

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

cans collected to recycle # people at game

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

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

$$N = 2.5P - 200$$

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
0	0
1	3
2	6
3	9

> +3
> +3

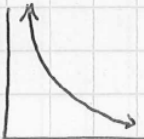
↑ Linear

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

12. $y = -5x + 6$

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

13. [b]



← 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 $x \uparrow$ by 1, y mult by $\frac{1}{3}$

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

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

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

$$6(100) + 13$$

$$600 + 13$$

$$\boxed{613}$$

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

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

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

$$500 + 10 - 20$$

$$60 - 20$$

$$\boxed{40}$$

17. $x + y = 10$ $x + y = 10$
 $- (2x + y) = -12$ $-2x - y = -12$

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

$$x = 2$$

$$x + y = 10$$

$$2 + y = 10$$

$$y = 8$$

$$\boxed{(2, 8)}$$

18. 2 Expressions Equivalent to

$$x(5-6) + 13x - 10$$

$$\boxed{5x - 6x + 13x - 10} \leftarrow \#1$$

$$-x + 13x - 10$$

$$\boxed{12x - 10} \leftarrow \#2$$

(various answers)

19.

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

$$> \times 1.2$$

$$> \times 1.2$$

$$> \times 1.2$$

$$> \times 1.2$$

$$> \times 1.2$$

$$> \times 1.2$$

b. $y = (1.2)^x$

c. growth factor is $\boxed{1.2}$

d. growth rate is $\boxed{20\%}$

20. $5x + y \leq 10$

$$12x - y \leq 10$$

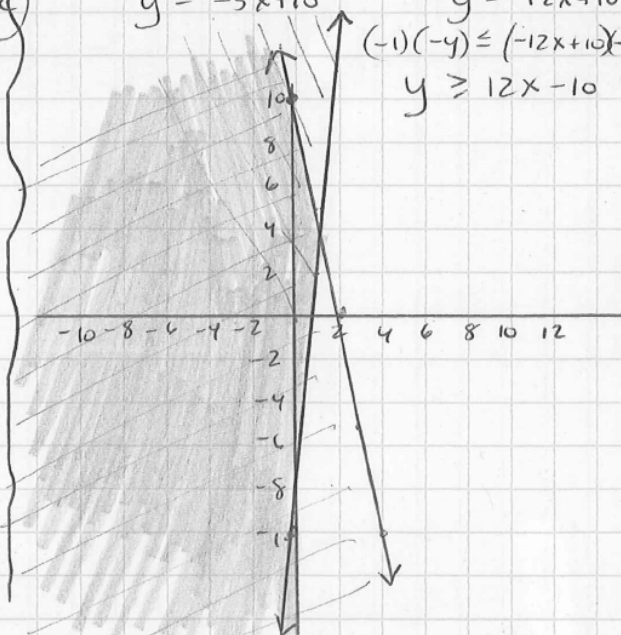
$$-5x \quad -5x \quad -12x \quad -12x$$

$$y \leq -5x + 10$$

$$-y \leq -12x + 10$$

$$(-1)(-y) \leq (-1)(-12x + 10)$$

$$y \geq 12x - 10$$



21. \overline{AB}

$$\begin{aligned}
 6^2 + 8^2 &= c^2 \\
 36 + 64 &= c^2 \\
 100 &= c^2 \\
 10 &= c
 \end{aligned}$$

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

\overline{CD}

$$\begin{aligned}
 3^2 + 5^2 &= c^2 \\
 9 + 25 &= c^2 \\
 34 &= c^2 \\
 \sqrt{34} &= c
 \end{aligned}$$

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

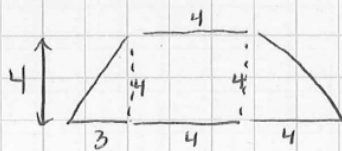
22.

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



Left:

$$\begin{aligned}
 3^2 + 4^2 &= c^2 \\
 9 + 16 &= c^2 \\
 25 &= c^2 \\
 5 &= c
 \end{aligned}$$

Right:

$$\begin{aligned}
 4^2 + 4^2 &= c^2 \\
 16 + 16 &= c^2 \\
 32 &= c^2 \\
 5.7 &= c
 \end{aligned}$$

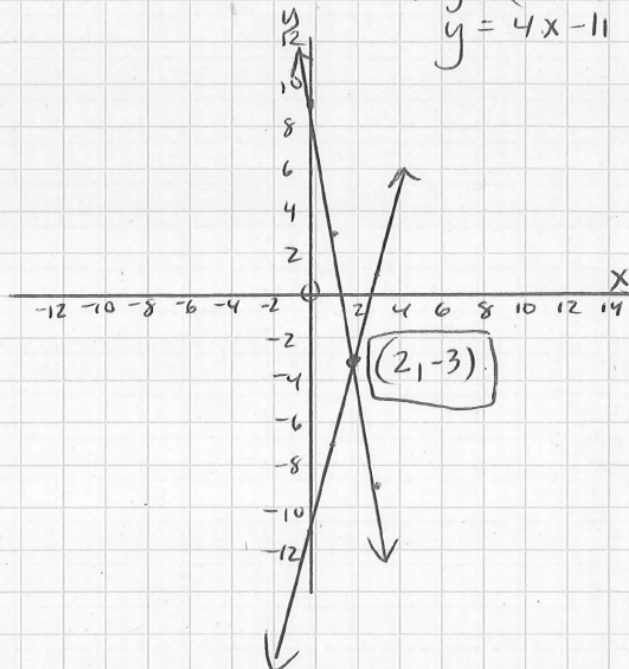
Lengths:
 Bottom 11
 Top 4
 Left side 5
 Right side 5.7
 Perim: 25.7 cm

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

25. $6x + y = 9$ $4x - y = 11$

$$\begin{array}{r}
 6x + y = 9 \\
 -6x \quad -6x \\
 \hline
 y = -6x + 9
 \end{array}$$

$$\begin{array}{r}
 4x - y = 11 \\
 -4x \quad -4x \\
 \hline
 -y = -4x + 11 \\
 (-1) \cdot y = (-1)(-4x + 11) \\
 y = 4x - 11
 \end{array}$$



CHECK

$$\begin{array}{ll}
 6x + y = 9 & 4x - y = 11 \\
 6(2) + (-3) = 9 & 4(2) - (-3) = 11 \\
 12 - 3 = 9 & 8 + 3 = 11 \\
 9 = 9 \checkmark & 11 = 11 \checkmark
 \end{array}$$

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. $y \leq -2x$
 $y \leq -\frac{1}{2}x + 2$ (i) (iii) (ix)
g. $x \geq -2$ h. $y \geq -2$ i. $-2 < x$
(ii) (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. $(0,8)$ $(4,13)$
y-int. given!

x	y
0	8
4	13

$$\frac{\Delta y}{\Delta x} = \frac{5}{4} = m$$

$$y = mx + b$$

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

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

$$y = mx + b$$

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

$$4 = -3 + b$$

$$+3 \quad +3$$

$$7 = b$$

$$y = -3x + 7$$

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

x	y
1	1
3	9

$$\frac{\Delta y}{\Delta x} = \frac{8}{2} = 4 = m$$

$$y = mx + b$$

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

$$1 = 4 + b$$

$$-4 \quad -4$$

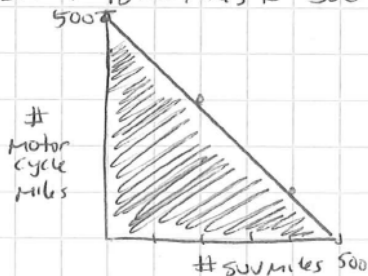
$$-3 = b$$

$$y = 4x - 3$$

29. S = # miles SUV drives

M = # miles motorcycle drives

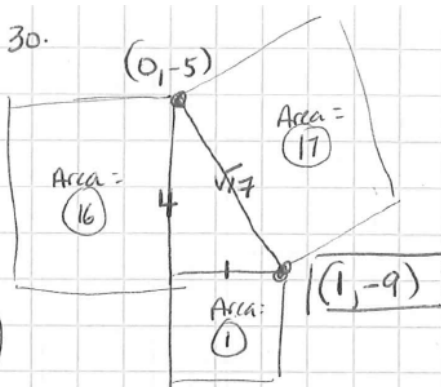
Limit total miles to 500: $S + M \leq 500$



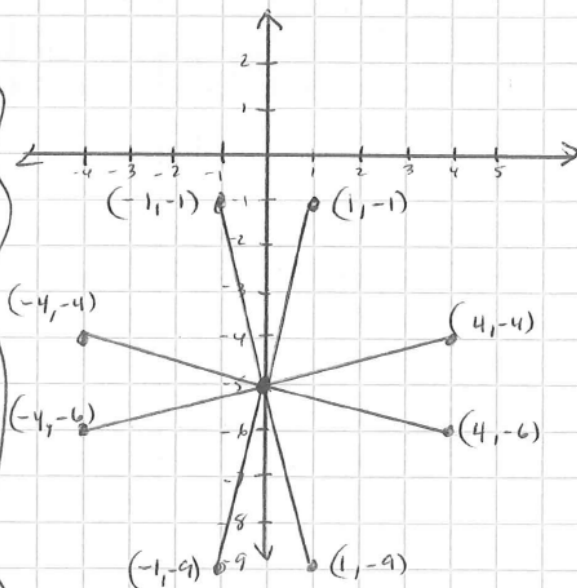
S	M
0	500
200	300
400	100
500	0

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

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

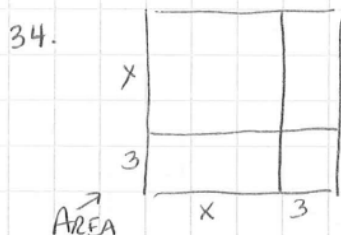
ii

iii

Must be pos (opens up)

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

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



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

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

$$\begin{array}{r} 6x - 10y = 14 \\ 6x + 10y = 10 \\ \hline 12x = 24 \\ 12 \end{array}$$

$x = 2$

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

$$\begin{array}{r} 3x - 5y = 7 \\ 3(2) - 5y = 7 \\ 6 - 5y = 7 \\ -6 \quad -6 \\ \hline -5y = 1 \\ -5 \quad -5 \\ \hline y = -\frac{1}{5} \end{array}$$

CHECK:

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

36.

x	y
0	$\frac{1}{16}$
1	$\frac{1}{4}$
2	1
3	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
 $15 - 0.10n$

38.

YR	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 = 0.9
 $\frac{4500}{5000} = \frac{4050}{4500} = \frac{y_2}{y_1}$

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

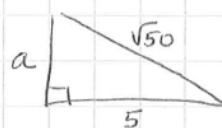
d. 2009 pop is below 2000 whales

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

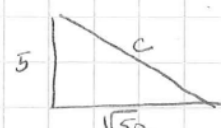
CHECK
 $4x + 19 = 26 - 3x$
 $4(1) + 19 = 26 - 3(1)$
 $4 + 19 = 26 - 3$
 $23 = 23 \checkmark$

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

41.



$$\begin{array}{r} a^2 + b^2 = c^2 \\ a^2 + 5^2 = (\sqrt{50})^2 \\ a^2 + 25 = 50 \\ -25 \quad -25 \\ \hline a^2 = 25 \\ \boxed{a = 5} \text{ OR} \end{array}$$



$$\begin{array}{r} a^2 + b^2 = c^2 \\ 5^2 + (\sqrt{50})^2 = c^2 \\ 25 + 50 = c^2 \\ 75 = c^2 \\ \boxed{\sqrt{75} = c} \end{array}$$

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 $\boxed{6}$

$$\begin{array}{r} 6 \quad 36 \quad 216 \text{ etc.} \\ 1 \quad 6 \quad 36 \end{array}$$

SUBSTITUTION

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

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

$2x + 10x + 120 = 36$

$12x + 120 = 36$

$-120 \quad -120$

$$\begin{array}{r} 12x \\ 12 \end{array} = \begin{array}{r} -84 \\ 12 \end{array}$$

$x = \boxed{-7}$

$y = x + 12$

$y = -7 + 12$

$y = 5$

CHECK

$y = x + 12$

$5 = -7 + 12$

$5 = 5 \checkmark$

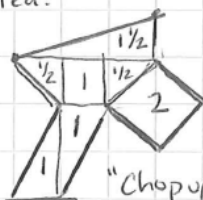
$2x + 10y = 36$

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

$-14 + 50 = 36$

$36 = 36 \checkmark$

Area:

"Chop up
+ add"
strategy

Total Area

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

44.

45.

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

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

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

b. # students if \$ is 690

$C = 15x + 450$

$690 = 15x + 450$

$-450 \quad -450$

$$\begin{array}{r} 240 \\ 15 \end{array} = \begin{array}{r} 15x \\ 15 \end{array}$$

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

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!)

$\text{Costs} \leq 1000$

$15x + 450 \leq 1000$

$-450 \quad -450$

$$\begin{array}{r} 15x \\ 15 \end{array} \leq \begin{array}{r} 550 \\ 15 \end{array}$$

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

less than 37 students

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

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

a. How high after 5 sec?

$$h = t(50 - 3t)$$

$$h = 5(50 - 3(5))$$

$$h = 5(50 - 15)$$

$$h = 5(35)$$

$$h = \boxed{175 \text{ meters}}$$

b. What is time when rocket is 200 m.

$$h = t(50 - 3t)$$

$$200 = t(50 - 3t)$$

$$200 = 50t - 3t^2 \leftarrow \text{Quadratic!}$$

$$+3t^2 \quad +3t^2$$

$$3t^2 + 200 = 50t$$

$$-50t \quad -50t$$

$$3t^2 - 50t + 200 = 0 \leftarrow \text{Factor}$$

$$(3t - 20)(t - 10) = 0$$

$$3t - 20 = 0$$

$$+20 + 20$$

$$\frac{3t}{3} = \frac{20}{3}$$

$$\boxed{t = 6.7 \text{ sec} \quad t = 10 \text{ sec.}}$$

↑ 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. Breakeven Where Profit = 0!

$$0 = x^2 - 11x - 80 \leftarrow \text{Quadratic!}$$

$$0 = (x - 16)(x + 5)$$

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

$x = -5 \leftarrow \text{not possible to sell neg videos}$

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

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

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

50. $(2, 2)$

$(-2, -4)$

$x | y$

-2 | -4

2 | 2

$-4 < 2 > +6$

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

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. $2x + 4y = 14$

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

$$\frac{4y}{4} = \frac{-2x + 14}{4}$$

$$y = -\frac{1}{2}x + \frac{7}{2}$$

$$\boxed{y = -\frac{1}{2}x + \frac{7}{2}}$$

$$\boxed{y = -\frac{1}{2}x + \frac{7}{2}}$$

$$x - 15y = 45$$

$$-x \quad -x$$

$$\frac{-15y}{-15} = \frac{-x + 45}{-15}$$

$$y = \frac{1}{15}x - 3$$

$$\boxed{y = \frac{1}{15}x - 3}$$

$$\boxed{y = \frac{1}{15}x - 3}$$