

# 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

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

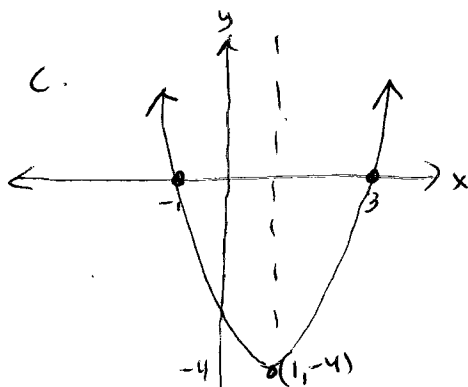
$y = (1)^2 - 2(1) - 3$

$y = 1 - 2 - 3$

$y = -4$

vertex 1, -4

[Open up]



2.  $P = -90h + 495$

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

$0 = -90h + 495$

$-495 \quad -495$

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

$5.5 = h$  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  $\Delta$

$P = -90h + 495$

$\uparrow$  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

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

$+20x \quad +20x$

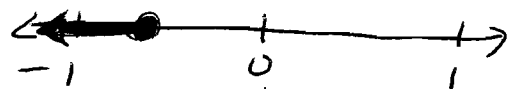
$-11 \geq 14 + 35x$

$-14 \quad -14$

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

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

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



5.

hours	dose
1	90
2	85

$> x \cdot .94$

decay factor (multiplier) is  $.94$

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

Equation

$$y = \underset{\substack{\uparrow \\ \text{starting} \\ \text{amt}}}{a} \underset{\substack{\uparrow \\ \text{multiplier}}}{b}^x$$

x	y
0	95.3
1	90
2	85

going backwards divide by  $.94$

$x \cdot .94$

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

6. a.  $(-4x^3y)^2 (2y^2)$   
 $(16x^6y^2)(2y^2)$   
 $32x^6y^4$

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

c.  $(2^{-3})(4^0)(2^4)$   
 $(\frac{1}{8})(1)(16) = 2$

7 Solve  $2x^2 - x = 15$   
 $\frac{-15 \quad -15}{2x^2 - x - 15 = 0}$

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

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

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

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

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

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

10.  $\overset{\substack{\# \text{ cans} \\ \text{collected to} \\ \text{recycle}}}{N} = 2.5(\overset{\substack{\# \text{ people at} \\ \text{game}}}{P} - 40) - 100$   
 $N = 2.5P - 100 - 100$   
 $N = 2.5P - 200$

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.  $\overset{300 \text{ cans}}{N} = 2.5P - 200$   
 $300 = 2.5P - 200$   
 $+200 \quad +200$   
 $\frac{500}{2.5} = \frac{2.5P}{2.5}$

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

11.

Layer	# 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  $y = \frac{1}{5}x + (\text{anything})$

13. [6]



← 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.  $5x^2 + x - 20$   $x = 10$

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

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

$$500 + 10 - 20$$

$$510 - 20$$

[490]

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

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

19.

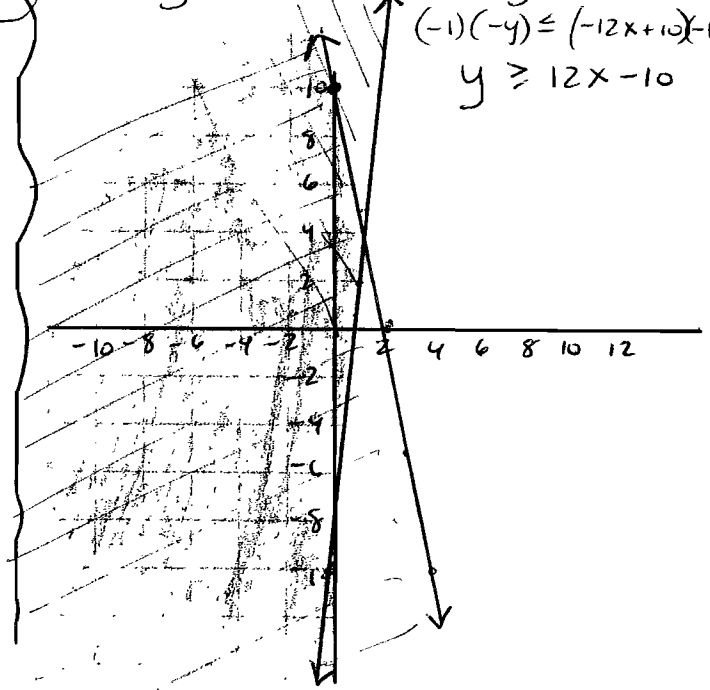
x	y
0	1
1	1.2
2	1.44
3	1.728
4	2.0736
5	2.48832

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

$\overline{CD}$

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

$$25 + 9 = c^2$$

$$34 = c^2$$

$$\sqrt{34} = c$$

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

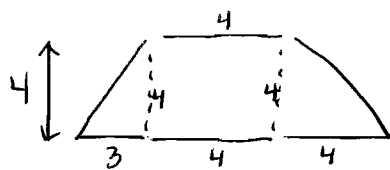
22.

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  $\Delta y$  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:

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

$$9 + 16 = c^2$$

$$25 = c^2$$

$$5 = c$$

Right:

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

$$16 + 16 = c^2$$

$$32 = c^2$$

$$5.7 = c$$

Length:

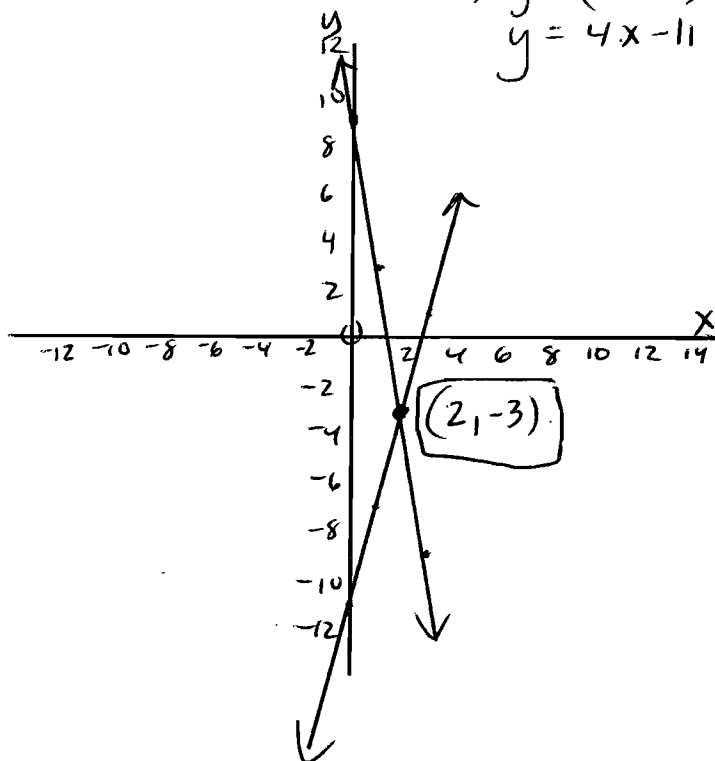
Bottom	11
Top	4
Left side	5
Right side	5.7

Perim : 25.7 CM

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

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

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



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.  $y \leq -2x$   
 $y \leq -\frac{1}{2}x + 2$  (i) (iii) (ix)  
g.  $x \geq -2$  (ii) h.  $y \geq -2$  (iv) i.  $-2 \leq x$  (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

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

$$y = mx + b$$

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

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

$$y = mx + b$$

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

$$4 = -3 + b$$

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

$$y = -3x + 7$$

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

x	y
1	1
3	9

$+2 < 1 > +8$       $\frac{\Delta y}{\Delta x} = \frac{8}{2} = 4 = m$

$$y = mx + b$$

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

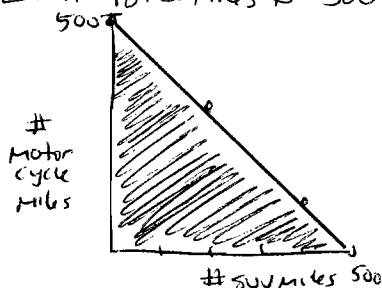
$$9 = 12 + b$$

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

$$y = 4x - 3$$

29. S = # miles SUV drives  
M = # miles Motorcycle drives

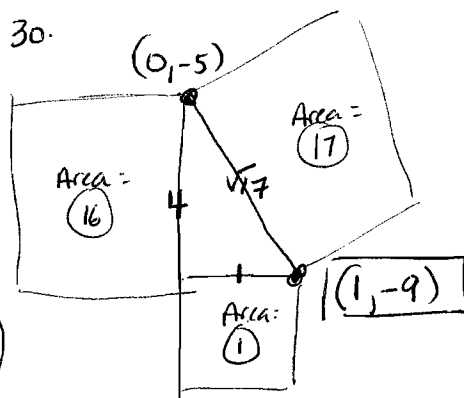
Limit total miles to 500:  $S + M \leq 500$



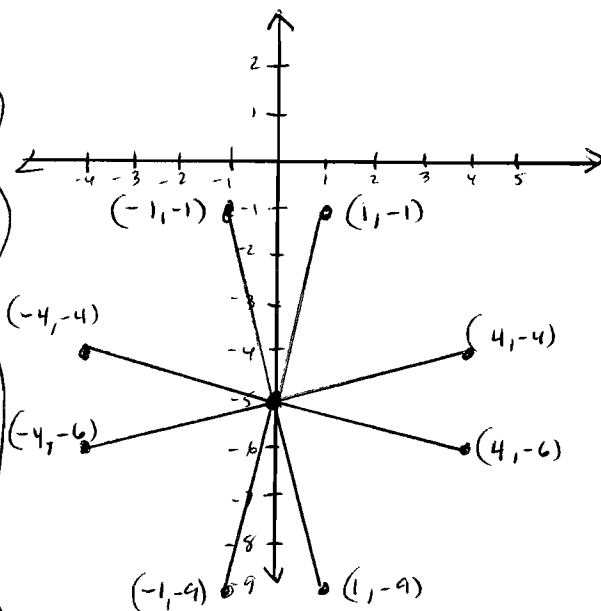
S	M
0	500
200	300
400	100
500	0

Simple solutions for exactly 500

30.



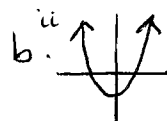
Other possible answers: (legs must be 1+4)



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

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

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

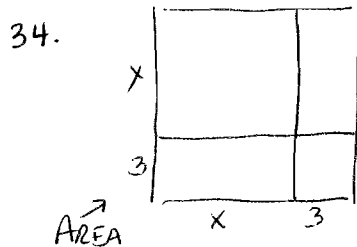


b.  $y = ax^2 + bx + c$

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

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

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

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

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

a.  $I = \left(\frac{\$}{\text{cost}}\right) \left(\frac{\text{price}}{\text{meal}}\right)$   
 b.  $I = n(15 - .10n)$

Price/meal is  
 $15 - .10n$

38.

y	w	whales
2000 →	0	5000
+1	1	4500
	2	4050
	3	3645
	4	3250
	5	2857
	6	2464
	7	2071
	8	1678
	9	1285

a.  $W = 5000(.9)^y$   
 b. decay factor =  $.9$   
 $\frac{4500}{5000} = \frac{4050}{4500} = \frac{3645}{4050} = \frac{3250}{3645} = \frac{2857}{3250} = \frac{2464}{2857} = \frac{2071}{2464} = \frac{1678}{2071} = \frac{1285}{1678} = .9$

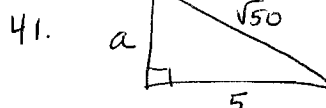
c. 2007:  
 $2657(.9) = 2391$   
 Whales

d. 2009 pop is below 2000 whales

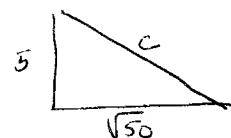
39.  $4x + 19 = 26 - 3x$   
 $+ 3x$   
 $7x + 19 = 26$   
 $-19 \quad -19$   
 $7x = 7$   
 $\frac{7x}{7} = \frac{7}{7}$   
 $x = 1$

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

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



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



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

42.

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

a. 

5	7776
---	------

b.  $y = 6^x$

c. Growth Factor is 6  
 $\frac{6}{1}$   $\frac{36}{6}$   $\frac{216}{36}$  etc.

SUBSTITUTION

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

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

$2x + 10x + 120 = 36$

$12x + 120 = 36$

$-120 \quad -120$

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

$x = -7$

$y = x + 12$

$y = -7 + 12$

$y = 5$

CHECK

$y = x + 12$

$5 = -7 + 12$

$5 = 5 \checkmark$

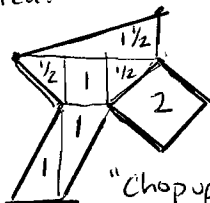
$2x + 10y = 36$

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

$-14 + 50 = 36$

$36 = 36 \checkmark$

Area:



"Chop up  
+ add"  
strategy

Total Area

$7\frac{1}{2} \text{ units}^2$

44.

45. # students # cost

+10 < 0	450	> +150
+10 < 10	600	> +150
+10 < 20	750	> +150
+20 < 40	1050	> +300

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

a.  $C = 15x + 450$

b. # students if # is 690

$C = 15x + 450$

$690 = 15x + 450$

$-450 \quad -450$

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

$16 \text{ students} = x$

c. 12 students  $\rightarrow$  ?? #

$C = 15x + 450$

$C = 15(12) + 450$

$C = 180 + 450$

$C = \$630$

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  $36 \text{ students or fewer}$

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.

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

↑ 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 →

$$\begin{aligned} P &= x^2 - 11x - 80 \\ 100 &= x^2 - 11x - 80 \\ -100 \quad -100 \\ \hline 0 &= x^2 - 11x - 180 \\ 0 &= (x - 20)(x + 9) \\ \boxed{x = 20 \text{ videos}} \\ x = -9 &\leftarrow \text{not possible} \end{aligned}$$

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.

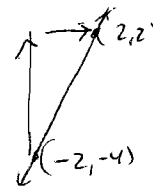
n	number
1	2
2	6
3	12
4	20

$n^{\text{th}}$  # is always

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

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

50.



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

y-int on graph (0, -1)

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

$x \mid y$    
 $-2 \mid -4$    
 $2 \mid 2$    
 $+4 <$    
 $> +6$

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

52.  $2x + 4y = 14$    
 $-2x \quad -2x$

$x - 15y = 45$    
 $-x \quad -x$

$$\begin{aligned} 4y &= -2x + 14 \\ -2x \quad -2x \\ \hline 4y &= -2x + 14 \\ -15y &= -x + 45 \\ -15 \quad -15 \\ \hline \end{aligned}$$

$$\begin{aligned} y &= -\frac{1}{2}x + \frac{7}{2} & y &= \frac{1}{15}x - 3 \\ \uparrow & \quad \uparrow & \uparrow & \quad \uparrow \\ m & \quad b & m & \quad b \end{aligned}$$