Pre-Calculus 11 Ch# 9 Test Review Name: KEY

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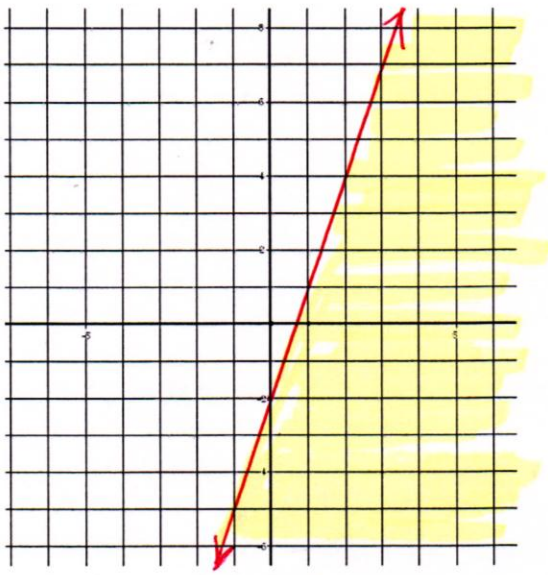
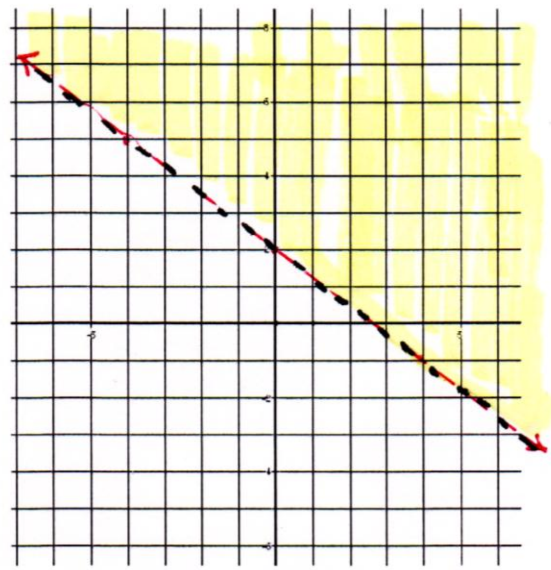
1. Graph each inequality without using technology.

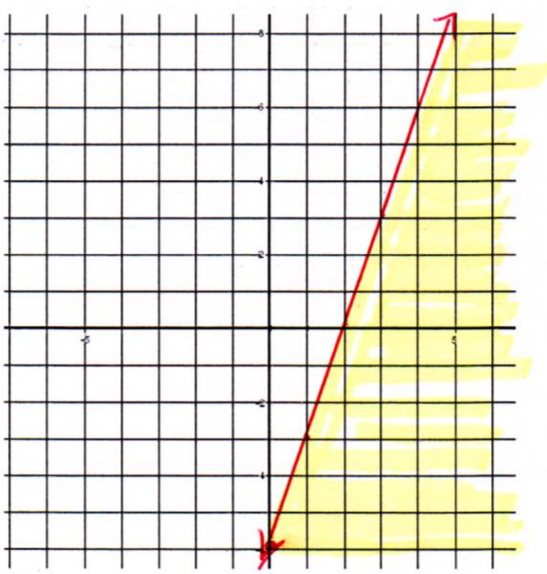
a) $y \leq 3x - 2$



b) $y > -\frac{3}{4}x + 2$

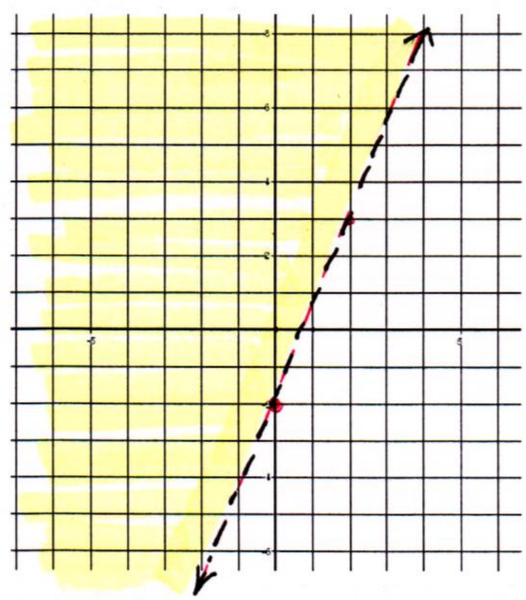


c) $3x - y \geq 6$ $3x - 6 \geq y$



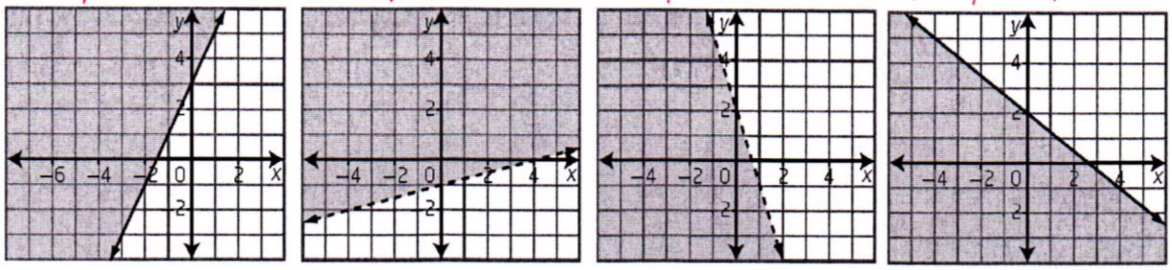
d) $10x - 4y + 3 < 11$ $10x - 8 < 4y$

$\frac{5}{2}x - 2 < y$



2. Determine the inequality that corresponds to each of the following graphs.

a) $y = 2x + 3$ **b)** $y = \frac{1}{4}x - 1$ **c)** $y = -3x + 2$ **d)** $y = \frac{-3}{4}x + 2$



$y \geq 2x + 3$ $y > \frac{1}{4}x - 1$ $y < -3x + 2$ $y \leq \frac{-3}{4}x + 2$

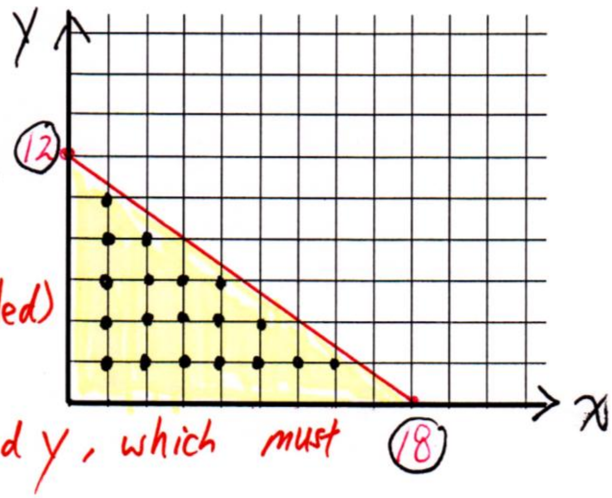
3. Janelle has a budget of \$120 for entertainment each month. She usually spends the money on a combination of movies and meals. Movie admission, with popcorn, is \$15, while a meal costs \$10.

a) Write an inequality to represent the number of movies and meals that Janelle can afford with her entertainment budget. Let x be the # of movies with popcorn; y be the # of meals.

$120 \geq 15x + 10y$

$-\frac{3}{2}x + 12 \geq y$; $x \geq 0$, $y \geq 0$

b) Graph the solution.



c) Interpret your solution. Explain how the solution to the inequality relates to Janelle's situation.

The solution region (shaded) in quadrant (I) shows the combinations of x and y, which must be whole numbers.

4. Jodi is paid by commission as a salesperson. She earns 5% commission for each laptop computer she sells and 8% commission for each DVD player she sells. Suppose that the average price of a laptop is \$600 and the average price of a DVD player is \$200.

a) What is the average amount Jodi earns for selling each item?

Commission from laptop: $5\% \cdot (600) = \$30$

Commission from DVD player: $8\% (200) = \$16$

b) Jodi wants to earn a minimum commission this month of \$1000. Write an inequality to represent this situation.

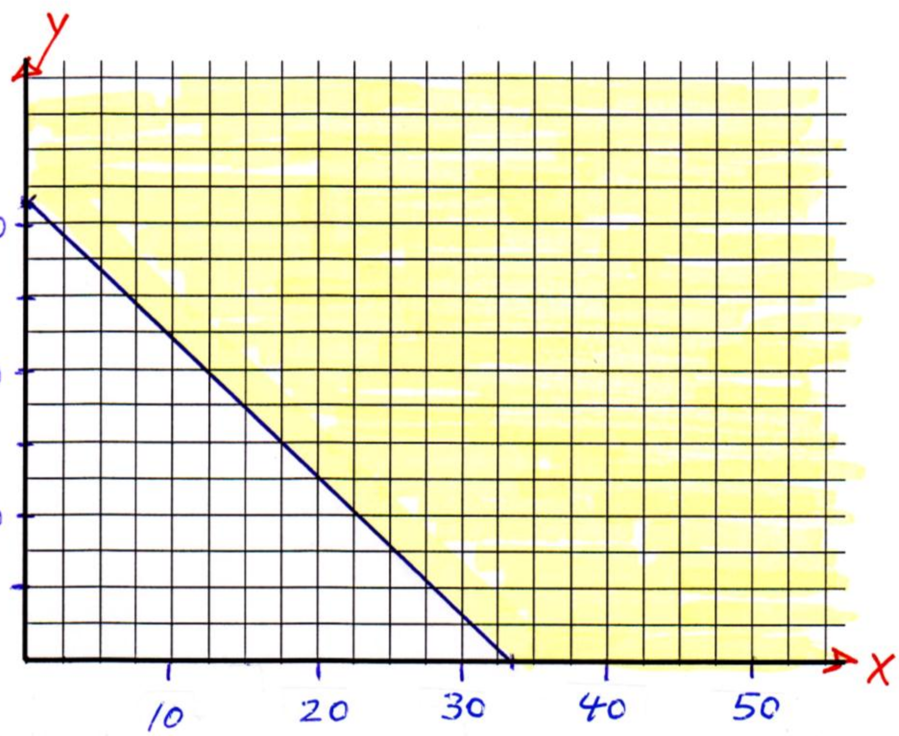
Let x be the # of laptops sold
y " " " DVD players sold.

$30x + 16y \geq 1000$

c) Graph the inequality. Interpret your results in the context of Jodi's earnings.

$16y \geq -30x + 1000$

$y \geq \frac{-15}{8}x + 62.5$



The solution region (shaded) is above the line in quadrant (I) shows which combinations will give the desired commission. The values of x and y must be whole numbers.

5. Solve each inequality.

a) $x^2 - 2x - 63 > 0$

Find roots.

$x^2 - 2x - 63 = 0$

roots $(x-9)(x+7) = 0$

$x = 9$ or $x = -7$

$\boxed{\text{Solutions: } x < -7,\ x > 9,\ x \in R}$

$-7 \quad 9$

b) $2x^2 - 7x - 30 \geq 0$

Find roots.

$2x^2 - 7x - 30 = 0 \qquad (2x+5)(x-6) = 0$

roots $x = \frac{-5}{2}$ or $x = 6$

$\boxed{\text{Solutions: } x \leq -\frac{5}{2},\ x \geq 6,\ x \in R}$

$-\frac{5}{2} \quad 6$

c) $4x^2 < 10x - 1 \rightarrow 4x^2 - 10x + 1 < 0$

Find roots. $x = \frac{10 \pm \sqrt{100-16}}{8}$

$x = \frac{5 \pm \sqrt{21}}{4} \nearrow 2.4,\ \searrow 0.10$

$\boxed{\text{Solutions: } \frac{5-\sqrt{21}}{4} < x < \frac{5+\sqrt{21}}{4},\ x \in R}$

$0.10 \quad 2.4$

d) $5x^2 \geq 4 - 12x \longrightarrow 5x^2 + 12x - 4 \geq 0$

Find roots: $x = \frac{-12 \pm \sqrt{144+80}}{10}$

$x = \frac{-6 \pm 2\sqrt{14}}{5} \nearrow 0.30,\ \searrow -2.70$

$\boxed{\text{Solutions: } x \leq \frac{-6-2\sqrt{14}}{5},\ x \geq \frac{-6+2\sqrt{14}}{5}}$ $x \in R$

$-2.70 \quad 0.30$

6. A decorative fountain shoots water in a parabolic path over a pathway. To determine the location of the pathway, the designer must solve the inequality $-\frac{3}{4}x^2 + 3x \geq 2$, !!

where x is the horizontal distance from the water source, in metres.

a) Solve the inequality.

b) Interpret the solution to the inequality for the fountain designer.

a) $-\frac{3}{4}x^2 + 3x - 2 \geq 0$

Find roots: $x = \frac{-3 \pm \sqrt{9-6}}{-\frac{3}{2}} = \frac{6 \pm 2\sqrt{3}}{3} \nearrow \approx 3.15,\ \searrow \approx 0.85$

Solutions:

$\frac{6-2\sqrt{3}}{3} \leq x \leq \frac{6+2\sqrt{3}}{3}$

$x \in R$

$0.85 \quad 3.15$

b) The path has to be between those 2 points to allow people up to 2 m in height to walk under the water!

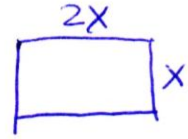
7. A rectangular storage shed is to be built so that its length is twice its width. If the maximum area of the floor of the shed is 18 m^2, what are the possible dimensions of the shed?

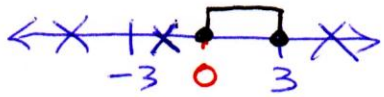
$$\text{Area} = 18 = L \cdot W$$

$$18 \geq 2x \cdot x \Rightarrow 18 \geq 2x^2$$

$$9 \geq x^2$$

$$\cancel{-3} \leq x \leq 3$$





Ans: The maximum width can be 3 m and maximum length is 6 m or anything less than those values.

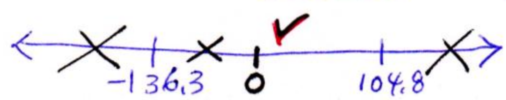
8. David has learned that the light from the headlights reaches about 100 m ahead of the car he is driving. If v represents David's speed, in km/h, then the inequality $0.007v^2 + 0.22v \leq 100$ gives the speeds at which David can stop his vehicle in 100 m or less.

a) What is the ***maximum*** speed at which David can travel and safely stop his vehicle in the 100-m distance?

Solve: $0.007v^2 + 0.22v - 100 \leq 0$

find roots: $v = \dfrac{-0.22 \pm \sqrt{2.8484}}{0.014}$

$= 104.8$ or $= \cancel{-136.3}$



The maximum speed is 104.8 km/h.

b) Modify the inequality so that it gives the speeds at which a vehicle can stop in 50 m or less.

$$0.007v^2 + 0.22v \leq 50$$

Solve $0.007v^2 + 0.22v - 50 \leq 0$

Find roots: $v = \dfrac{-0.22 \pm \sqrt{1.4484}}{0.014}$

$= 70.2$ or $= \cancel{-101.7}$

Solutions: $0 \leq v \leq 70.2$ km/h

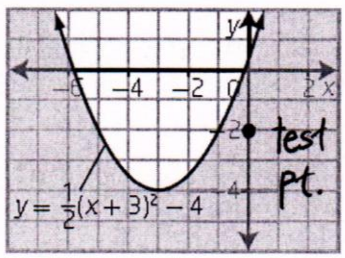
$v \in R$

c) Solve the inequality you wrote in part b). Explain why your answer is not half the value of your answer for part a).

The solution: $0 \leq v \leq 70.2$. The maximum speed is 70.2 km/h which is not half of answer from part a) because the function is quadratic, not linear.

9. Write an inequality to describe each graph, given the function defining the boundary parabola.

a)



$V: (-3, -4)$

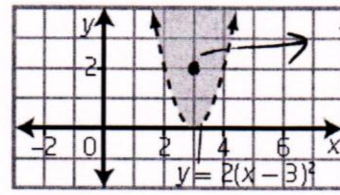
$a = \frac{1}{2}$

$y \le \frac{1}{2}(x+3)^2 - 4$

$-2 \qquad \frac{9}{2} - 4$

$-2 < 0.5$

b)



test pt. $(3, 2)$

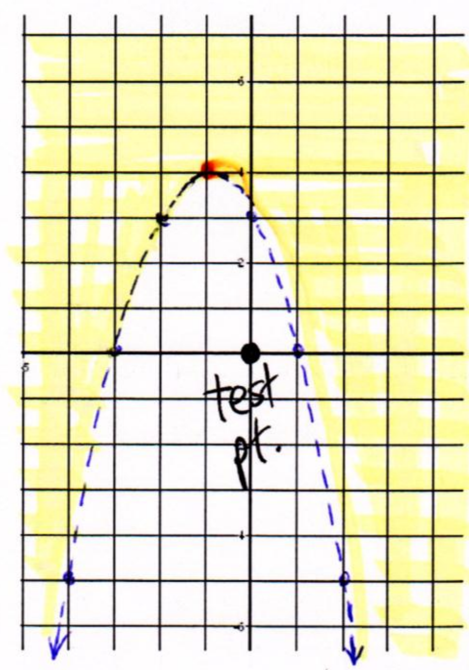
$y > 2(x-3)^2$

$2 > 0$

10. Graph each quadratic inequality.

a) $y > -x^2 - 2x + 3$

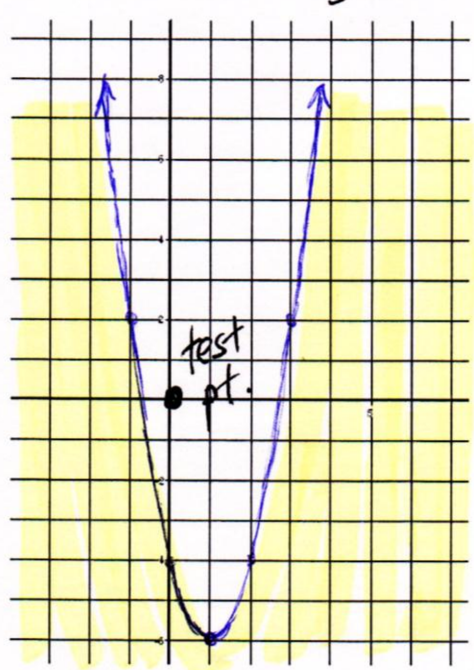
$p = \frac{2}{-2} = -1 \qquad q = -1 + 2 + 3 = 4$



dashed line!

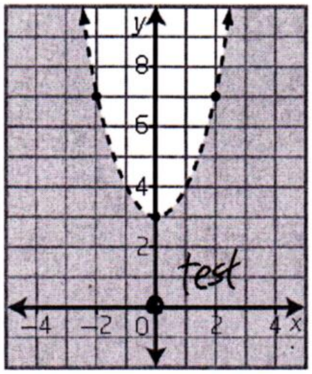
b) $y \le 2(x-1)^2 - 6$

solid line!



11. Write an inequality to describe each graph.

a)



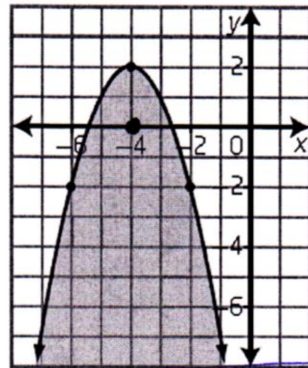
$a = 1$

$V: (0, 3)$

test pt: $(0, 0)$

$\boxed{y < (x)^2 + 3}$

b)



$a = -1$

$V: (-4, 2)$

test pt: $(-4, 0)$

$\boxed{y \leq -(x+4)^2 + 2}$

$0 \leq \quad +2$

12. You can model the ***maximum*** Saskatchewan wheat production for the years 1975 to 1995 with the function $y = 0.003t^2 - 0.052t + 1.986$, where t is the time, in years, after 1975 and y is the yield, in tonnes per hectare.

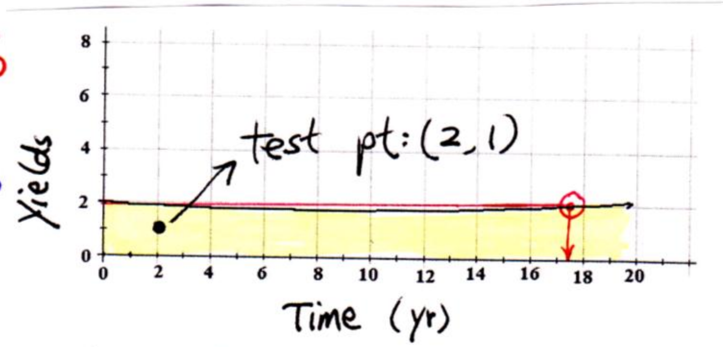
a) Write and graph an inequality to model the potential wheat production during this period.

From 1975 to 1995, $0 \leq t \leq 20$

$y \leq 0.003t^2 - 0.052t + 1.986$

$1 \quad 0.003(2)^2 - 0.052(2) + 1.986$

$1 < 1.894$



b) Write and solve an inequality to represent the years in which production is at most 2 t/ha.

$2 \leq 0.003t^2 - 0.052t + 1.986$

$0 \leq 0.003t^2 - 0.052t - 0.014$

$t = 17.6 \longrightarrow$ yr: $1975 + 17.6$

yr of $= 1992.6$

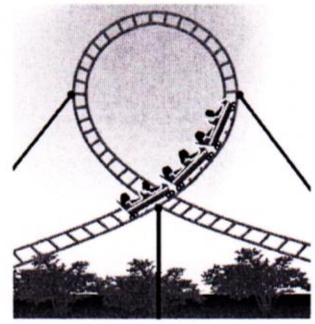
find roots.

$t = \dfrac{0.052 \pm \sqrt{0.002872}}{0.006}$

17.6 yr $\quad$ ~~-0.265 yr~~

From 1975 to roughly 1992.6, the yields is at most 2t/ha.

13. An engineer is designing a roller coaster for an amusement park. The speed at which the roller coaster can safely complete a vertical loop is approximated by $v^2 \geq 10r$, where v is the speed, in metres per second, of the roller coaster and r is the radius, in metres, of the loop.



a) Graph the inequality to examine how the radius of the loop is related to the speed of the roller coaster.

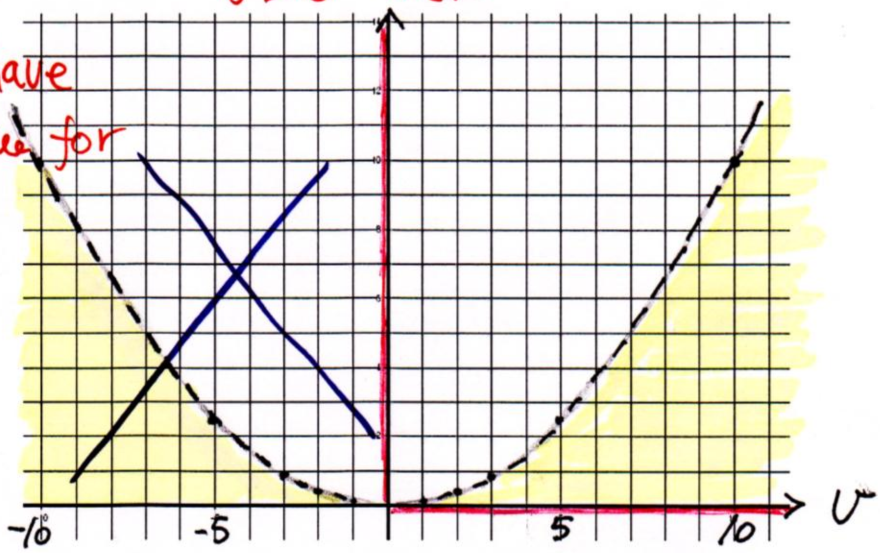
$10r < v^2$

$r < \frac{1}{10}v^2$

$\therefore$ $r \geq 0,\ r \in R$

$v \geq 0,\ v \in R$

you cannot have a negative value for the speed or the radius.



b) A vertical loop of the roller coaster has a radius of 16 m. What are the possible safe speeds for this vertical loop?

Solve

$16 < \frac{1}{10}v^2$

$v \geq 12.65\ m/s.$

find roots.

$160 = v^2$

$\sqrt{160} = v = \pm 12.65\ m/s.$

$\cancel{-12.6\ m/s}$ is rejected.

Any speed above 12.65 m/s will complete the loop with $r = 16$ m.