b.) How high will it go?

$h = 490m$

5. A ball is thrown directly upward from ground level with an initial speed of 80 ft/sec.

a.) When will it return to the ground?

$t = 0$ (starting point)

$t = 50$ sec (return to the ground)

b.) How high will it go?

$h = 100ft$

Solving Polynomial Inequalities

The final section in this unit is solving polynomial inequalities. The use of factoring and graphing are the keys to solving these problems.

What does $ab > 0$ *and* $ab < 0$ mean?

the product of a·b is greater than 0

ab > 0 → means… that the product of a and b is a positive number

** So, a and b are either both positive numbers OR both negative numbers. (Example: 20 → (4)(5) OR (−4)(−5))

the product of a·b is less than 0

ab < 0 → means… that the product of a and b is a negative number

** So, a and b are either (−a)(b) OR (a)(−b) (Example: −20 → (−4)(5) OR (4)(−5))

Example: Find and graph the solution set of $x^2 + 3x < -2$.

+2 +2

① $x^2 + 3x + 2 < 0$ ← open points

Need to find the region with the negative product.

② Factor: $(x+2)(x+1) < 0$

③ $x + 2 = 0$ $\quad$ $x + 1 = 0$

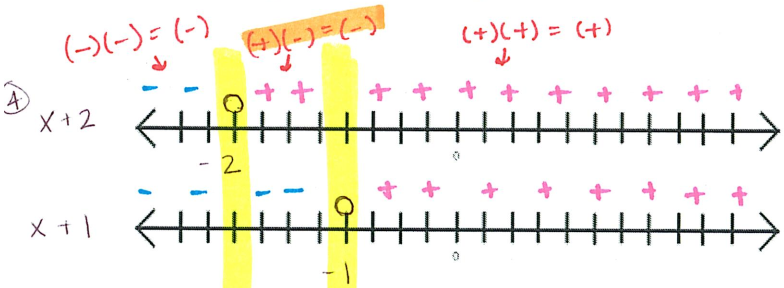
−2 −2 $\quad$ −1 −1

$x = -2$ $\quad$ $x = -1$

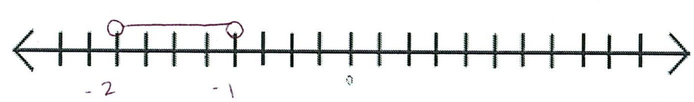
Steps:

1. Set one side of the inequality to zero.
2. Factor
3. Identify the "breaking points"
4. Graph separate number lines and combine
5. Identify the solution

④



⑤ Solution set: $-2 < x < -1$



Break for Practice: Find and graph the solution set to each inequality.

1. $x^2 + 15x \leq 4x - 24$ ⟹

+24 −4x −4x +24

① $x^2 + 11x + 24 \leq 0$ ← Closed points

Need to find the region with a negative product.

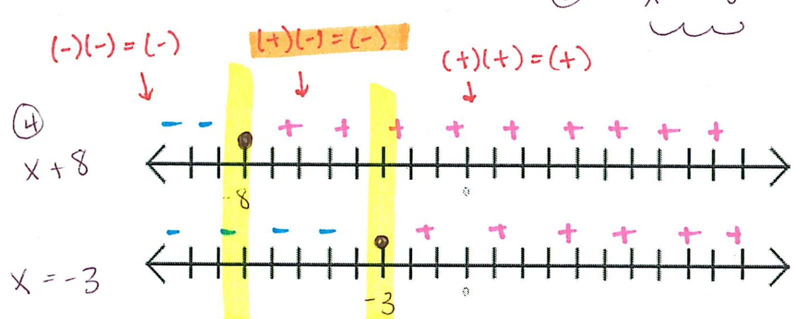
② $(x+8)(x+3) \leq 0$

$x + 8 = 0$ $\quad$ $x + 3 = 0$

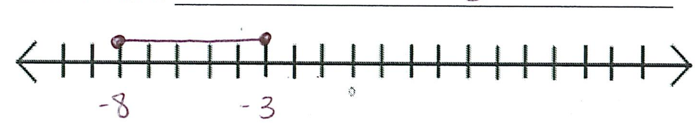
−8 −8 $\quad$ −3 −3

③ $x = -8$ $\quad$ $x = -3$

④



⑤ Solution set: $-8 \leq x \leq -3$



2. $9r(r-1) \geq -2$

$9r^2 - 9r \geq -2$

$+2 \quad +2$

① $9r^2 - 9r + 2 \geq 0$

② $9r^2 - 3r - 6r + 2 \geq 0$

$3r(3r-1) - 2(3r-1) \geq 0$

$(3r-1)(3r-2) \geq 0$

③ $3r - 1 = 0$ $\quad$ $3r - 2 = 0$

$+1 \quad +1$ $\quad$ $+2 \quad +2$

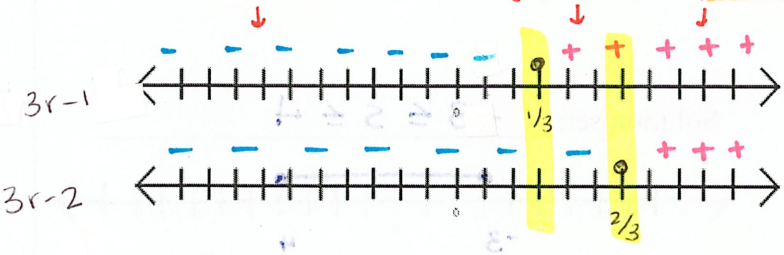
$\frac{3r}{3} = \frac{1}{3}$ $\quad$ $\frac{3r}{3} = \frac{2}{3}$

$r = 1/3$ $\quad$ $r = 2/3$

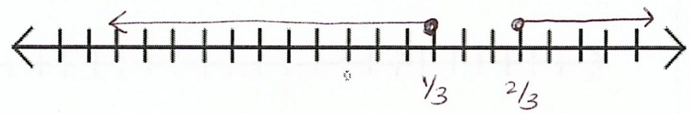
Closed points

Need to find the region with a positive product.

(-)(-)=(+) $\quad$ (+)(-)=(-) $\quad$ (+)(+)=(+)



Solution set: $x \leq 1/3$ OR $x \geq 2/3$



① 3. $25x - x^3 > 0$

② $x(25 - x^2) > 0$ (GCF)

open points

Need to find the region with a positive product.

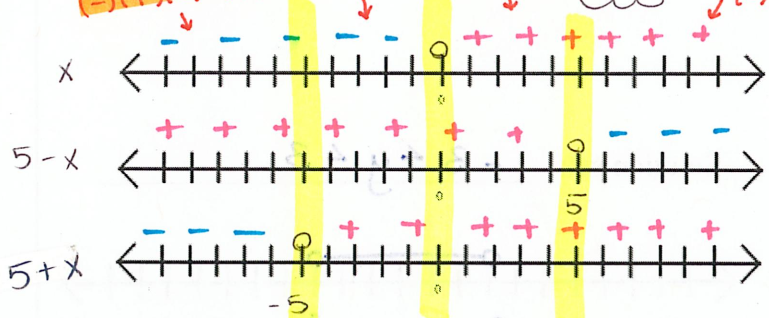
$x(5-x)(5+x) > 0$ (Diff of Squares)

③ $x = 0$ $\quad$ $5 - x = 0$ $\quad$ $5 + x = 0$

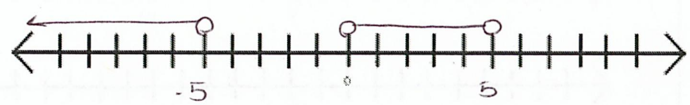
$+x \quad +x$ $\quad$ $-5 \quad -5$

$5 = x$ $\quad$ $x = -5$

(-)(+)(-)=(+) $\quad$ (-) $\quad$ (+) $\quad$ (-)

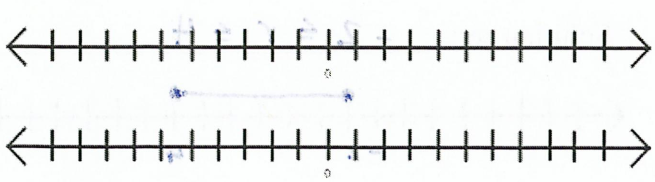


Solution set: $x < -5$ or $0 < x < 5$

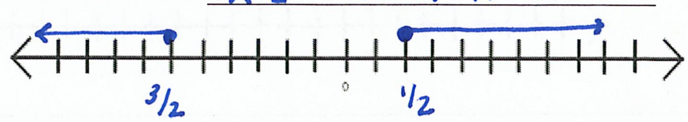


Extended Practice: Find and graph the solution set to each inequality.

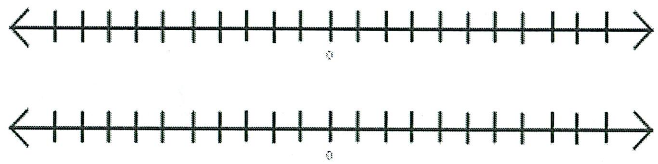
1. $4x(x+1) \geq 3$



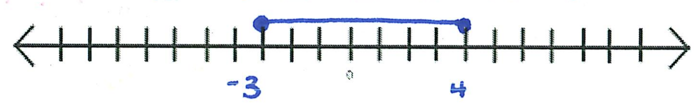
Solution set: $x \leq -3/2$ or $x \geq 1/2$



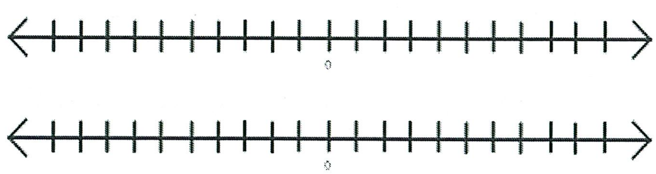
2. $12 + s - s^2 \geq 0$



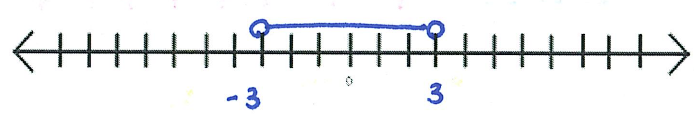
Solution set: $-3 \le s \le 4$



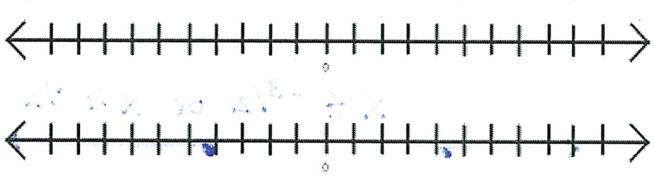
3. $4y^2 < 36$



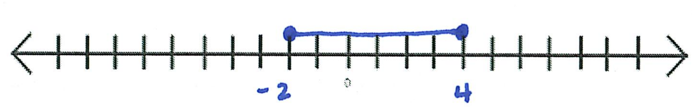
Solution set: $-3 < y < 3$



4. $r^2 \leq 2(r + 4)$

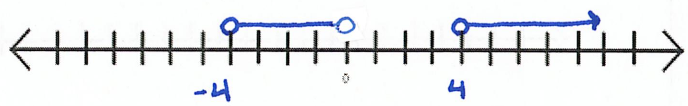


Solution set: $-2 \le r \le 4$



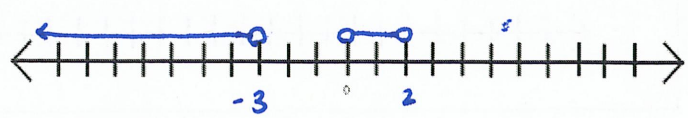
5. $x^3 - 16x > 0$

Solution set: $-4 < x < 0$ or $x > 4$



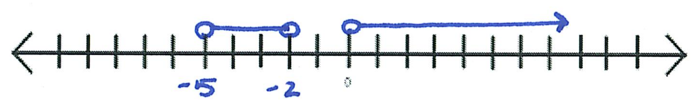
6. $y^3 + y^2 < 6y$

Solution set: $y < -3$ or $0 < y < 2$



7. $z^3 + 7z^2 + 10z > 0$

Solution set: $-5 < z < -2$ or $z > 0$



8. $4z(z-1) \leq 15$

Solution set: $-3/2 \leq z \leq 5/2$