

Due date: \_\_\_\_\_

Name: \_\_\_\_\_

## Getting Ready for Derivatives (Part 3)

Notesex: Solve  $x^3 - x^2 - 9x + 9 > 0$ .

$$x^2(x-1) - 9(x-1) > 0$$

$$(x-1)(x^2-9) > 0$$

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



$$(x-1)(x+3)(x-3) \quad - \quad 0 \quad + \quad 0 \quad - \quad 0 \quad +$$

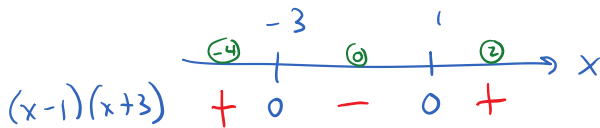
$$(-)(-)(-) \quad (-)(+)(-) \quad (+)(+)(-) \quad (+)(+)(+)$$

$$\text{Solution: } \boxed{(-3, 1) \cup (3, \infty)}$$

1. Solve the following inequalities.

a)  $x^2 + 2x - 3 < 0$

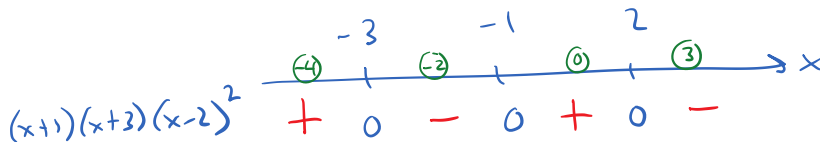
$$(x-1)(x+3) < 0$$



$$\text{Solution: } \boxed{(-3, 1)}$$

b)  $(x+1)(x+3)(x-2)^2 \geq 0$

$$\begin{array}{ccc} \uparrow & \uparrow & \uparrow \\ -1 & -3 & 2 \end{array}$$



$$\text{Solution: } \boxed{(-\infty, -3] \cup [-1, 2]}$$

**Notes**

Recall the following formulas:

Volume of a sphere with radius  $r$ :  $\frac{4}{3}\pi r^3$

Note:  $\frac{d}{dr} \left( \frac{4}{3}\pi r^3 \right) = 4\pi r^2$

Surface area of a sphere with radius  $r$ :  $4\pi r^2$

**Practice at home**

2. Solve the following inequalities.

a)  $2x^2 - x - 6 \leq 0$

$$(2x - 3)(x + 1) \leq 0$$

$(2x-3)(x+1)$   
 $\uparrow$   $\uparrow$   
 $3/2$   $-1$   
 $-2$   $0$   $3/2$   $2$   
 $+$   $0$   $-$   $0$   $+$   
 Solution:  $[-1, 3/2]$

b)  $3x^2 + 7x - 6 > 0$

$$(3x - 2)(x + 3) > 0$$

$(3x-2)(x+3)$   
 $\uparrow$   $\uparrow$   
 $2/3$   $-3$   
 $-4$   $-3$   $0$   $2/3$   $1$   
 $+$   $0$   $-$   $0$   $+$   
 Solution:  $(-\infty, -3) \cup (2/3, \infty)$

c)  $x^3 - 3x^2 - 4x + 12 < 0$

$$x^2(x-3) - 4(x-3) < 0$$

$$(x-3)(x^2-4) < 0$$

$$(x-3)(x+2)(x-2) < 0$$

$\uparrow$   $\uparrow$   $\uparrow$   
 $3$   $-2$   $2$

$(x-3)(x+2)(x-2)$   
 $-$   $0$   $+$   $0$   $-$   $0$   $+$   
 Solution:  $(-\infty, -2) \cup (2, 3)$

d)  $(x-1)^2(2x-3)(x+2)^3 \geq 0$

$\uparrow$   $\uparrow$   $\uparrow$   
 $1$   $3/2$   $-2$

$(x-1)^2(2x-3)(x+2)^3$   
 $+$   $0$   $-$   $0$   $-$   $0$   $+$   
 Solution:  $(-\infty, -2] \cup [3/2, \infty)$