

## Quiz14, MAT 1375 Professor Chiu

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

- This quiz consists of 2 sets of questions for a total of 10 points.
- You have 15 minutes to complete the quiz.
- Scientific calculators are allowed.
- Wishing you success.

True or False questions:

1. T  $x = 3$  satisfies the inequality  $x^3 + 15x \geq 7x^2 + 9$ .
2. T  $e^x$  is an exponential equation.
3. F  $x^5$  is an exponential equation.
4. T The domain of an exponential equation is  $(-\infty, \infty)$ .
5. T Given an exponential equation  $f(x) = b^x$  where  $b > 1$ . Then  $f(x) \rightarrow \infty$  as  $x \rightarrow \infty$ .

*Please turn over for the next question.*

Show all your work and justify your answer:

6. Use the 3-step strategy to solve for  $x$ :

$$x^3 - 2x^2 - 5x + 6 \geq 0.$$

(Hint: you can find a root of  $x^3 - 2x^2 - 5x + 6$  from  $x = \pm 1, \pm 2, \pm 3, \pm 6$ )

Step 1  $x^3 - 2x^2 - 5x + 6 = 0$  and test the roots:

$$x=1, (1)^3 - 2(1)^2 - 5(1) + 6 = 1 - 2 - 5 + 6 = 0 \Rightarrow x=1 \text{ is a root and } x-1 \text{ is a factor of } x^3 - 2x^2 - 5x + 6.$$

By long division, we have

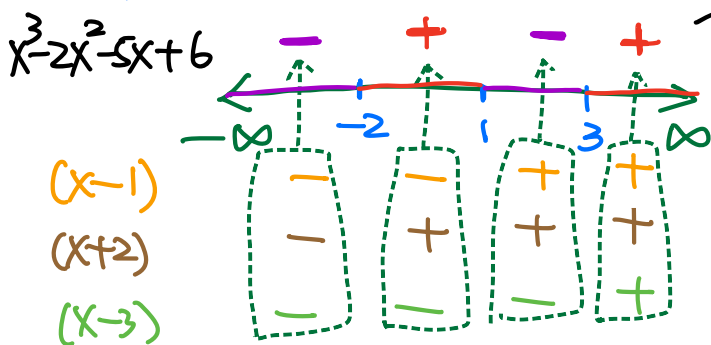
$$x^3 - 2x^2 - 5x + 6 = (x-1) \cdot (x^2 - x - 6) = 0$$

$$\Rightarrow (x-1)(x+2)(x-3) = 0$$

$$\Rightarrow x-1=0, x+2=0, x-3=0$$

$\Rightarrow x=1, x=-2, x=3$  are three roots of  $x^3 - 2x^2 - 5x + 6$

Step 2 Number line:



these mean

- $x^3 - 2x^2 - 5x + 6$  is "−" (negative) ( $x^3 - 2x^2 - 5x + 6 < 0$ ) when  $x \in (-\infty, -2) \cup (1, 3)$
- $x^3 - 2x^2 - 5x + 6$  is "+" (positive) ( $x^3 - 2x^2 - 5x + 6 > 0$ ) when  $x \in (-2, 1) \cup (3, \infty)$

Step 3 Check the endpoint:  $x=-2, x=1, x=3$

Since  $x=-2, x=1,$  and  $x=3$  are roots of  $x^3 - 2x^2 - 5x + 6$ , then each of them will make  $x^3 - 2x^2 - 5x + 6 = 0$ .

Since the original question asks for " $x^3 - 2x^2 - 5x + 6 \geq 0$ ", then the  $x$  should be  $[-2, 1] \cup [3, \infty)$