Pre-Calculus Name: Date: Period:

Unit 3 Practice Test
Learning Targets: 3A-3D

Complete the problems below, show your work, and write your answer in the blank provided.

Learning Target 3A—I can solve quadratic equations by factoring, quadratic formula, and completing the square.

1. Solve $0 = -13x^2 + 5x + 6$ by graphing. Round to the nearest hundredth.

Graph $y = -13x^2 + 5x + 6$ and find x-intercepts:

$\boldsymbol{x = -.51 \text{ and } .94}$

2. Solve $4(x-3)^2 + 5 = -25$ using the square root method.

$$4(x-3)^2 + 5 = -25$$
$$(x-3)^2 = -\frac{30}{4}$$
$$(x-3) = \pm\sqrt{-\frac{30}{4}}$$
$$x - 3 = \pm\frac{\sqrt{30}}{2}i$$
$$\boldsymbol{x = 3 \pm \frac{\sqrt{30}}{2}i}$$

3. Solve $x^2 + x = 6$ by factoring.

$$x^2 + x - 6 = 0$$
$$(x+3)(x-2) = 0$$
$$\boldsymbol{x = -3, 2}$$

4. Solve $x^2 - 6x + 4 = 0$ by completing the square.

$$x^2 - 6x = -4$$
$$x^2 - 6x + 9 = 5$$
$$(x-3)^2 = 5$$
$$x - 3 = \pm\sqrt{5}$$
$$\boldsymbol{x = 3 \pm \sqrt{5}}$$

5. Solve $2x^2 - 3x + 5 = 0$ using the quadratic formula.

$$2x^2 - 3x + 5 = 0$$
$$x = \frac{3 \pm i\sqrt{31}}{4} = \boldsymbol{\frac{3}{4} \pm \frac{\sqrt{31}}{4}i}$$

6. Find the exact solution using any method $6x^2 + 2x + 3 = 1$.

$$6x^2 + 2x + 2 = 0$$
$$3x^2 + x + 1 = 0$$
$$x = \frac{-1 \pm i\sqrt{11}}{6} = \boldsymbol{-\frac{1}{6} \pm \frac{\sqrt{11}}{6}i}$$

Target 3B

I can identify the extrema, symmetry, and zeros of polynomial functions and use them to graph and model with these functions.

7. Factor the function and find it's real zeros: $f(x) = x^4 - 5x^2 + 4$

$$\boldsymbol{f(x) = (x^2 - 4)(x^2 - 1)}$$
$$\boldsymbol{= (x + 2)(x - 2)(x + 1)(x - 1)}$$
$$\boldsymbol{zeros: -2, 2, -1, 1}$$

8. State the number of possible real zeros and turning points (extrema) of each function. Then determine all of the real zeros by factoring. in completely factored form using your calculator, synthetic division and/or factoring.

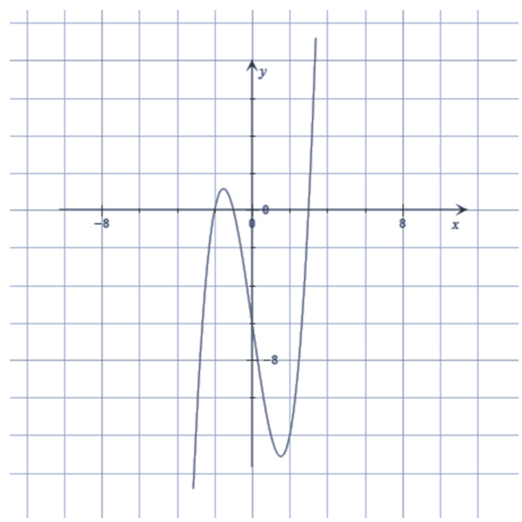
$$f(x) = x^3 - 7\,x - 6$$

x-intercepts at $x = 3, x = -1, and\ x = -2$. This gives us the factors

$$\boldsymbol{y = (x - 3)\ (x + 1)\ (x + 2)}$$

9. Sketch a complete graph of the function $f(x)$. List the exact coordinates of the x-intercepts, y-intercepts, and zeros.

x-intercepts at $x = 3, x = -1, and\ x = -2.$
y-intercept at $y = -6,$
zeros at $x = 3, x = -1, and\ x = -2.$



10. Solve the following inequality.
$2x^2 + x - 10 < 5$

$$\boldsymbol{-3 < x < \frac{5}{2}}$$

or

$$\boldsymbol{\left(-3, \frac{5}{2}\right)}$$

11. Use the table below to find a *Cubic regression* model and predict the value of the function when $x = 10$.

x	1	2	3	4	5	6
y	.2	1.7	7.2	15.3	36.2	53.7

$$\boldsymbol{g(x) = -.0593x^3 + 3.1508x^2 - 8.7471x + 6.2333}$$

$$\boldsymbol{g(10) = -.0593(10)^3 + 3.1508(10)^2 - 8.7471(10) + 6.2333 = 174.5423}$$

Target 3C

I can describe and apply the Fundamental Theorem of Algebra to find real and complex solutions of polynomial equations

12. What is the fundamental theorem of Algebra?

Every n^{th} degree polynomial has exactly n complex zeros.

13. Use your calculator to find the approximate real solutions to the equation

$$2x^4 - 3x^3 + 2 = 0$$

$$\textbf{There are no real zeros because the graph has no } x - \textbf{intercepts}.$$

Are there any complex solutions to this equation (you don't need to find them if there are)? If so, how many? Explain how you know.

There are 4 imaginary zeros because the fundamental theorem of Algebra states that a 4^{th} degree polynomial must have 4 zeros.

Solve the equations. You may use your calculator (to start), synthetic division, factoring, or the quadratic formula. Leave answers as exact answers in simplified form.

14. $x^3 + x^2 - 4\,x - 4 = 0.$

$$x = -1 \text{ or } x = -2 \text{ or } x = 2$$

15. $x^3 - 3\,x^2 = -5\,x + 15$

$$x^3 - 3x^2 + 5x - 15 = 0$$

$$(x - 3)\left(x^2 + 5\right) = 0$$

$$\textbf{Solutions}:\ x = \left\{3, \pm i\sqrt{5}\right\}$$

Target 3D – No Calculator

I can graph rational functions and identify their asymptotes.

16. Consider $g(x) = \frac{2\,x^2-5\,x-3}{x^2-2\,x-3} = \frac{(x-3)(2x+1)}{(x-3)(x+1)}$

a. State the domain of $g(x)$.

$$\boldsymbol{Domain}: (-\infty, -1) \cup (-1, 3) \cup (3, \infty)$$

or

$$\boldsymbol{Domain} = \{x | x \neq -1, \boldsymbol{and}\ x \neq 3, \boldsymbol{and}\ x \in \mathbb{R}$$

a. Find the hole(s) in the graph and write your answer(s) as an equaion.

$$x = 3$$

Determine the roots (or zeros) of the function and write them as ordered pairs.

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

$$x = 3, \qquad or\ x = -\frac{1}{2}$$

$x = 3$ **is not in domain so, the only zero is**

$$\left(-\frac{1}{2}, 0\right)$$

b. Determine the vertical asymptote(s) and write the equations of the asymptote(s).

$$\boldsymbol{Vertical\ Asymptote}: x = -1$$

c. Graph the function, its roots, and its asymptotes (as dotted lines). Be sure and indicate any holes in the graph. Label your graph.

Divide rational function to find horizontal asymptote:

$$g(x) = \frac{2\,x^2-5\,x-3}{x^2-2\,x-3} = \frac{(x-3)(2x+1)}{(x-3)(x+1)} = \frac{2x+1}{x+1}$$

$$g(x) = 2 + \frac{-1}{x+1}$$

$$as\ x \to \pm\infty, y \to 2$$

$$\boldsymbol{Horizontal\ asymptote}: y = 2$$