Name:_____
MA131/135: College Algebra
Instructor: Justin Ryan
Midterm Exam 3—Chapter 3
Due by:

Butler Community College

Read and follow all instructions.

Part I: True or False [2 points each]
Read each statement carefully. In the space provided, write **T** *if the statement is always true, or* **F** *otherwise.*

_____**1.** A polynomial function of degree 5 has exactly 5 real zeros.

_____**2.** A polynomial function of degree 4 has at least 1 real zero.

_____**3.** A polynomial function of degree 6 with negative leading coefficient and positive y-intercept must have at least 2 real zeros.

_____**4.** Every polynomial of odd degree has an even number of turning points.

_____**5.** The polynomial function $P(x) = 3x^6 - 3x^2 - 3$ has no positive real roots larger than 2.

Part II: Fill in the Blank [2 points each]
Choose the appropriate word or phrase from the word bank, and write its corresponding letter in the space provided.

Word Bank:

A. zero	**B.** one	**C.** two
D. three	**E.** four	**F.** five
G. remainder	**H.** root	**I.** factor
J. quotient	**K.** divisor	**L.** squirrel

_____**6.** The polynomial function $P(x) = x^3 + 3x$ has _____ real zeros.

_____**7.** The polynomial function $P(x) = -x^5 + 9x + 13x^3 - 5x^4 + 2x^2 + 12$ has exactly _____ positive real root(s).

_____**8.** The polynomial function $P(x) = 9x^9 + 7x^7 + x^3 + 5x$ has _____ negative real roots.

_____**9.** If $x = k$ is a root of a polynomial function P, then $(x - k)$ is a _____ of P.

_____**10.** When dividing $P(x) = 3x^4 - 4x^2 + 9x - 12$ by $D(x) = x^2 - 3x + 2$, the term $3x^2 + 9x + 17$ is called the _____ .

Part III: Multiple Choice [4 points each]
Write the letter corresponding to the appropriate answer in the space provided.

_____**11.** Find the vertex of the function $P(x) = -2x^2 - 4x + 6$.

A. $(1, 8)$ **B.** $(4, 6)$

C. $(-1, 8)$ **D.** $(-4, 6)$

_____**12.** Solve the equation $6x^2 - 15x + 6 = 0$.

A. $x = 1, 2$ **B.** $x = -\frac{1}{2}, 2$

C. $x = 3, 12$ **D.** $x = \frac{1}{2}, 2$

_____**13.** Solve the equation $x^2 - 4x = 2$.

A. $x = -2 \pm \sqrt{6}$ **B.** $x = -2 \pm i\sqrt{2}$

C. $x = 2 \pm \sqrt{6}$ **D.** $x = 2 \pm i\sqrt{2}$

_____**14.** Solve the equation $3x^2 + 3x - 2 = 0$.

A. $x = -\frac{1}{2} \pm \frac{\sqrt{33}}{6}$ **B.** $x = \frac{1}{2} \pm \frac{\sqrt{33}}{6}$

C. $x = -\frac{1}{2} \pm \frac{i\sqrt{33}}{6}$ **D.** $x = \frac{1}{2} \pm \frac{i\sqrt{33}}{6}$

_____**15.** The function $f(x) = x^6 - 5x^5 + 3x^4 + x^3 + 40x^2 - 24x - 72$ has 3 as a root of multiplicity 2, 2 as a root of multiplicity 1, and -1 as a root of multiplicity 1. Find all other roots.

A. $x = -1 \pm i\sqrt{3}$ **B.** $x = 1 \pm \sqrt{3}$

C. $x = -1 \pm \sqrt{3}$ **D.** $x = 1 \pm i\sqrt{3}$

_____**16.** The function $f(x) = 4x^4 - 21x^2 - 25$ has i as a root. Find all roots of f.

A. $x = i, \pm\frac{5}{2}$ **B.** $x = \pm i, \pm 5$

C. $x = i, \pm 5$ **D.** $x = \pm i, \pm\frac{5}{2}$

_____**17.** Divide $\dfrac{3x^3 - 5x^2 + 6}{x - 1}$.

A. $3x^3 - 2x^2 - 2x + 4$ **B.** $3x^2 - 2x - 2 + \frac{4}{x-1}$

C. $\frac{3x^2-2x-2}{4}$ **D.** $3x^2 - 2x - 2$

_____**18.** Divide $\dfrac{x^4 - 2x + 6}{x^2 + 2}$.

A. $x^2 - 2 - 2x + 10$ **B.** $x^2 - 2 + \frac{-2x+2}{x^2+2}$

C. $\frac{x^2-2}{-2x+10}$ **D.** $x^2 - 2 + \frac{-2x+10}{x^2+2}$

_____**19.** Does the function $P(x) = 3x^4 + 5x^3 - 35x^2 - 55x + 22$ have a real root between $x = 3$ and $x = 4$?

A. Yes

B. No

C. Indeterminate

D.

_____**20.** Find a cubic polynomial with zeros at 4 and $2i$, and such that $f(1) = -15$.

A. $f(x) = x^3 - 4x^2 + 4x - 16$

B. $f(x) = x^3 + 4x^2 + 4x + 16$

C. $f(x) = x^2 - 16$

D. $f(x) = -15x^3 - 4x^2 + 4x$

_____**21.** Find all roots of the function $P(t) = 7t^2 + 3t + 4$.

A. $t = 3, 7$

B. $t = -\frac{3}{14} \pm \frac{\sqrt{103}}{14}$

C. $t = \frac{3}{14} \pm \frac{i\sqrt{103}}{14}$

D. $t = -\frac{3}{14} \pm \frac{i\sqrt{103}}{14}$

_____**22.** Describe the end behavior of the graph of the function

$$P(x) = -\sqrt{2}x^3 + 4x^2 + 2x - 4.$$

A. $\nwarrow \ldots \nearrow$

B. $\swarrow \cdots \searrow$

C. $\swarrow \ldots \nearrow$

D. $\nwarrow \ldots \searrow$

_____**23.** Divide the polynomial function $P(x) = 2x^3 + 3x^2 + 4x - 10$ by $D(x) = x + 1$.

A. $2x^2 + x + 3 - \frac{13}{x+1}$

B. $\frac{2x^2+x+3}{-13}$

C. $2x^2 + x + 3 - 13$

D. $2x^2 + x + 3 - 13(x + 1)$

_____**24.** Solve the equation $x^3 + 5x^2 - 14x = 0$.

A. $x = 0, 5, 9$

B. $x = -7, 0, 2$

C. $x = -\frac{5}{2} \pm \frac{9}{2}i$

D. $x = -7, 2$

_____**25.** Find a polynomial function with real coefficients of lowest possible degree having 2 and $6i$ as zeros.

A. $P(x) = x^3 + 2x^2 + 36x + 72$

B. $P(x) = x^2 - (2 + 6i)x + 12i$

C. $P(x) = x^2 - 8x + 12$

D. $P(x) = x^3 - 2x^2 + 36x - 72$

_____**26.** Let $P(x) = 2x^3 - 3x^2 - 4x + 19$. Use synthetic division to find $P(-3)$.

A. 50

B. -3

C. -50

D. 19

_____**27.** Find all (real *and* complex) solutions of equation

$$5x^4 + 7x^3 + 119x^2 + 175x - 150 = 0.$$

A. $x = 1, 2, 5, 30$

B. $x = -2, 1, \pm 5i$

C. $x = 1, 1, \pm i$

D. $x = -2, \frac{3}{5}, 5i, -5i$

_____**28.** Find a polynomial function P of lowest degree with $-3+4i$ as a root and $P(1) = 48$.

A. $P(x) = \frac{3}{2}x^2 + 9x + \frac{75}{2}$

B. $P(x) = 48x^2 + 6x + 25$

C. $P(x) = x^2 + 6x + 25$

D. $P(x) = 48(x^2 + 25)$

_____**29.** Let P be a quadratic function with a root at $5 - 12i$ and leading coefficient of -3. What is the vertex of P?

A. $(5, 12)$

B. $(-3, -432)$

C. $(5, -432)$

D. $(5, 432)$

_____**30.** What is the maximum number of positive roots of the function?

$$P(x) = 17x + 3x^3 + 7x^5 - 2x^2 - x^6 - 13x^4 - 5$$

A. 1

B. 4

C. 0

D. 6