PRACTICE 3

Student: _____ Date: _____	**Course:** College Algebra	Test 3 covers 3.1, 3.2, 3.3, 3.4 and 3.5

1. In the following exercise, find the coordinates of the vertex for the parabola defined by the given quadratic function.

   $f(x) = 3x^2 + 6x + 9$

   The vertex is _____ . (Type an ordered pair.)

2. Consider the function $f(x) = 3x^2 - 18x - 1$.

   a. Determine, without graphing, whether the function has a minimum value or a maximum value.
   b. Find the minimum or maximum value and determine where it occurs.
   c. Identify the function's domain and its range.

   a. The function has a (1) _____ value.

   b. The minimum/maximum value is _____ . It occurs at x = _____ .

   c. The domain of f is _____ . (Type your answer in interval notation.)

   The range of f is _____ . (Type your answer in interval notation.)

   (1) ○ maximum
       ○ minimum

3. Consider the function $f(x) = -3x^2 + 18x - 9$.

   a. Determine, without graphing, whether the function has a minimum value or a maximum value.
   b. Find the minimum or maximum value and determine where it occurs.
   c. Identify the function's domain and its range.

   a. The function has a (1) _____ value.

   b. The minimum/maximum value is _____ . It occurs at x = _____ .

   c. The domain of f is _____ . (Type your answer in interval notation.)

   The range of f is _____ . (Type your answer in interval notation.)

   (1) ○ maximum
       ○ minimum

4. Fill in each blank so that the resulting statement is true.

Consider the quadratic function $f(x) = ax^2 + bx + c$, $a \neq 0$. If $a > 0$, then f has a minimum that occurs at $x =$ _____. This minimum value is _____. If $a < 0$, then f has a maximum that occurs at $x =$ _____. This maximum value is _____.

Consider the quadratic function $f(x) = ax^2 + bx + c$, $a \neq 0$. If $a > 0$, then f has a minimum that occurs at

$x =$ (1) _____ This minimum value is (2) _____ If $a < 0$, then f has a maximum that occurs at

$x =$ (3) _____ This maximum value is (4) _____

(1)
○ $f\left(-\dfrac{b}{2a}\right)$.
○ $-\dfrac{b}{2a}$.
○ $f\left(\dfrac{2a}{b}\right)$.
○ $\dfrac{2a}{b}$.

(2)
○ $f\left(\dfrac{2a}{b}\right)$.
○ $f\left(-\dfrac{b}{2a}\right)$.
○ $-\dfrac{b}{2a}$.
○ $\dfrac{2a}{b}$.

(3)
○ $\dfrac{2a}{b}$.
○ $f\left(\dfrac{2a}{b}\right)$.
○ $f\left(-\dfrac{b}{2a}\right)$.
○ $-\dfrac{b}{2a}$.

(4)
○ $f\left(-\dfrac{b}{2a}\right)$.
○ $-\dfrac{b}{2a}$.
○ $f\left(\dfrac{2a}{b}\right)$.
○ $\dfrac{2a}{b}$.

5. Determine whether the function is a polynomial function. If it is, identify the degree.

$f(x) = 3x^6 + 5x^7$

Choose the correct choice below and, if necessary, fill in the answer box to complete your choice.

○ **A.** It is a polynomial. The degree of the polynomial is _____ .

○ **B.** It is not a polynomial.

6. Use the leading coefficient test to determine the end behavior of the graph of the given polynomial function.

$f(x) = 6x^7 - 2x^6 + 2x + 5$

○ **A.** Falls left & rises right.
○ **B.** Rises left & rises right.
○ **C.** Falls left & falls right.
○ **D.** Rises left & falls right.
○ **E.** None of the above.

7. Find the zeros for the polynomial function and give the multiplicity for each zero. State whether the graph crosses the x-axis or touches the x-axis and turns around at each zero.

$$f(x) = -7(x - 3)(x - 4)^2$$

Determine the zero(s).

The zero(s) is/are _____ .
(Type integers or decimals. Use a comma to separate answers as needed.)

Determine the multiplicities of the zero(s). Select the correct choice below and, if necessary, fill in the answer box(es) within your choice.

○ **A.** There are two zeros. The multiplicity of the smallest zero is _____ . The multiplicity of the largest zero is _____ .
(Simplify your answers.)

○ **B.** There is one zero. The multiplicity of the zero is _____ .
(Simplify your answer.)

○ **C.** There are three zeros. The multiplicity of the smallest zero is _____ . The multiplicity of the largest zero is _____ . The multiplicity of the other zero is _____ .
(Simplify your answers.)

Determine the behavior of the function at each zero. Select the correct choice below and, if necessary, fill in the answer boxes within your choice.

○ **A.** The graph crosses the x-axis at $x =$ _____ and touches the x-axis and turns around at $x =$ _____ .
(Simplify your answers. Type integers or decimals. Use a comma to separate answers as needed.)

○ **B.** The graph crosses the x-axis at all zeros.

○ **C.** The graph touches the x-axis and turns around at all zeros.

8. Use the given function to complete parts (a) through (e) below.

$$f(x) = x^4 - 9x^2$$

a) Use the Leading Coefficient Test to determine the graph's end behavior.

○ A. The graph of f(x) falls left and rises right.

○ B. The graph of f(x) falls left and falls right.

○ C. The graph of f(x) rises left and falls right.

○ D. The graph of f(x) rises left and rises right.

b) Find the x-intercepts.

x = _____
(Type an integer or a decimal. Use a comma to separate answers as needed.)

At which zeros does the graph of the function cross the x-axis? Select the correct choice below and, if necessary, fill in the answer box to complete your choice.

○ A.   x = _____   (Type an integer or a decimal. Use a comma to separate answers as needed.)

○ B. There are no x-intercepts at which the graph crosses the x-axis.

At which zeros does the graph of the function touch the x-axis and turn around? Select the correct choice below and, if necessary, fill in the answer box to complete your choice.

○ A.   x = _____   (Type an integer or a decimal. Use a comma to separate answers as needed.)

○ B. There are no x-intercepts at which the graph touches the x-axis and turns around.
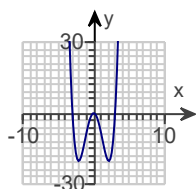
c) Find the y-intercept by computing f(0).
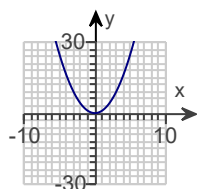
f(0) = _____

d) Determine the symmetry of the graph.

○ Odd; origin symmetry

○ Even; y-axis symmetry

○ Neither

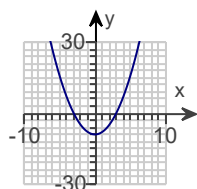e) Determine the graph of the function.
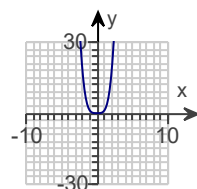
○ A.   ○ B.   ○ C.   ○ D.

9. Fill in the blank so that the resulting statement is true.

To divide $x^3 + 5x^2 - 4x + 1$ by $x - 3$ using synthetic division, the first step is to write

____|____ ____ ____ ____.

To divide $x^3 + 5x^2 - 4x + 1$ by $x - 3$ using synthetic division, the first step is to write

_____|_____ _____ _____ _____.

---

10. Divide using synthetic division.

$$\left(x^3 + 9x^2 - 4x + 8\right) \div (x - 5)$$

$\left(x^3 + 9x^2 - 4x + 8\right) \div (x - 5) = $ _____ $+ \dfrac{\overline{\qquad}}{x - 5}$

(Simplify your answers. Do not factor. Use integers or fractions for any numbers in the expressions.)

---

11. Divide using synthetic division.

$$\frac{x^5 + 3x^3 - 4}{x - 1}$$

$\dfrac{x^5 + 3x^3 - 4}{x - 1} = $ _____ $+ \dfrac{\overline{\qquad}}{x - 1}$

(Simplify your answers. Do not factor.)

---

12. Use synthetic division and the remainder theorem to find the indicated function value.

$$f(x) = 4x^3 - 2x^2 - 5x + 5; \ \ f(-4)$$

$f(-4) = $ _____

---

13. Fill in the blanks so that the resulting statement is true.

Consider solving $4x^3 + 23x^2 - 7x - 6 = 0$. The synthetic division shown below indicates that (1) _____ is a root.

```
-6 | 4    23   -7   -6
   |      -24   6    6
   ----------------------
     4    -1   -1    0
```

Based on the synthetic division, $4x^3 + 23x^2 - 7x - 6 = 0$ can be written in factored form as (2) _____

(1) ○ −6   (2) ○ $(x + 6)\left(4x^2 - x - 1\right) = 0.$
    ○ 6   ○ $(x - 6)\left(4x^2 + x + 1\right) = 0.$
                    ○ $(x + 6)\left(4x^2 + x - 1\right) = 0.$
                    ○ $(x - 6)\left(4x^2 - x - 1\right) = 0.$

---

14. Use the Rational Zero Theorem to list all possible rational zeros for the given function.

$$f(x) = 4x^4 - x^3 + 3x^2 - 2x - 22$$

Which of the following is the complete list of possible zeros of the given function?

○ **A.** $\pm 1, \pm 2, \pm 11, \pm \dfrac{1}{2}, \pm \dfrac{11}{2}$

○ **B.** $\pm 1, \pm 2, \pm 11, \pm 22, \pm \dfrac{1}{2}, \pm \dfrac{11}{2}, \pm \dfrac{1}{4}, \pm \dfrac{11}{4}$

○ **C.** $\pm 1, \pm 2, \pm \dfrac{11}{2}, \pm \dfrac{1}{4}, \pm \dfrac{11}{4}$

○ **D.** The function has no rational zeros.

---

*15. Find a polynomial function of degree 3 with real coefficients that has the given zeros.

$-1, 2, -4$

The polynomial function is $f(x) = x^3 + $ _____ $x^2 - 6x - 8$.

---

*16. The polynomial function f(x) has the given zero. Find the other zeros.

$$f(x) = x^3 + 4x^2 - 6x - 24; \ -4$$

The other zeros are _____ .
(Type exact answers, using radicals as needed. Use a comma to separate answers as needed.)

---

17. Find the domain of the following rational function.

$$H(x) = \frac{-9x^2}{(x-8)(x+6)}$$

Select the correct choice below and, if necessary, fill in the answer box to complete your choice.

○ **A.** The domain of H(x) is {x|x ≠ _____ }. (Type an integer or a fraction. Use a comma to separate answers as needed.)

○ **B.** The domain of H(x) has no restrictions.

18. Find the vertical asymptotes, if any, and the values of x corresponding to holes, if any, of the graph of the rational function.

$$f(x) = \frac{x - 8}{x^2 - 13x + 40}$$

Select the correct choice below and, if necessary, fill in the answer box(es) to complete your choice. (Type an integer or a fraction. Use a comma to separate answers as needed.)

○ **A.** Vertical asymptote(s) at x = _____ and hole(s) at x = _____

○ **B.** Vertical asymptote(s) at x = _____

○ **C.** Hole(s) at x = _____

○ **D.** There are no discontinuities.

19. Find the horizontal asymptote, if any, of the graph of the rational function.

$$g(x) = \frac{10x^2}{5x^2 + 4}$$

Select the correct choice below and, if necessary, fill in the answer box to complete your choice.

○ **A.** The horizontal asymptote is _____ . (Type an equation.)

○ **B.** There is no horizontal asymptote.

20. Find the horizontal asymptote, if any, of the graph of the rational function.

$$h(x) = \frac{14x^3}{7x^2 + 6}$$

Select the correct choice below and, if necessary, fill in the answer box to complete your choice.

○ **A.** The horizontal asymptote is _____ . (Type an equation.)

○ **B.** There is no horizontal asymptote.

1. $(-1,6)$

---

2. (1) minimum

   -28

   3

   $(-\infty,\infty)$

   $[-28,\infty)$

---

3. (1) maximum

   18

   3

   $(-\infty,\infty)$

   $(-\infty,18]$

4.

(1) $-\dfrac{b}{2a}$.

(2) $f\left(-\dfrac{b}{2a}\right)$.

(3) $-\dfrac{b}{2a}$.

(4) $f\left(-\dfrac{b}{2a}\right)$.

---

5. A. It is a polynomial. The degree of the polynomial is ____**7**____ .

---

6. A. Falls left & rises right.

---

7. 3,4

A.
There are two zeros. The multiplicity of the smallest zero is ____**1**____ . The multiplicity of the largest zero is
____**2**____ .
(Simplify your answers.)

A. The graph crosses the x-axis at x = ____**3**____ and touches the x-axis and turns around at x = ____**4**____ .
(Simplify your answers. Type integers or decimals. Use a comma to separate answers as needed.)
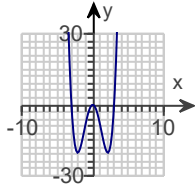
---

8. D. The graph of f(x) rises left and rises right.

　　$-3,3,0$

　A. x = _____ $-3,3$ _____ (Type an integer or a decimal. Use a comma to separate answers as needed.)

　A. x = _____ 0 _____ (Type an integer or a decimal. Use a comma to separate answers as needed.)

　0

　Even; y-axis symmetry

　A.

---

9. 3

　1

　5

　-4

　1

---

10. $x^2 + 14x + 66$

　338

---

11. $x^4 + x^3 + 4x^2 + 4x + 4$

　0

---

12. -263

---

13. (1) -6

　(2) $(x + 6)\left(4x^2 - x - 1\right) = 0.$

14.
　B. $\pm 1, \pm 2, \pm 11, \pm 22, \pm \dfrac{1}{2}, \pm \dfrac{11}{2}, \pm \dfrac{1}{4}, \pm \dfrac{11}{4}$

---

15. 3

---

16. $\sqrt{6}, -\sqrt{6}$

---

17. A.
   The domain of H(x) is {x|x ≠ ____**8, − 6**____}. (Type an integer or a fraction. Use a comma to separate answers as needed.)

18. A. Vertical asymptote(s) at x = ____**5**____ and hole(s) at x = ____**8**____

19. A. The horizontal asymptote is ____**y = 2**____ . (Type an equation.)

20. B. There is no horizontal asymptote.