

Name: _____

MA131/135: College Algebra

Instructor: Justin Ryan

Midterm Exam 2—Sections 2.4–3.3



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. The difference quotient of a function f represents the slope of the tangent line to the graph of $y = f(x)$ at the point $(x, f(x))$.
- _____ 2. Real numbers are also complex numbers.
- _____ 3. The number $\sqrt{-25}$ is pure imaginary.
- _____ 4. The inequality $x^2 + 6x + 9 < 0$ has no real solutions.
- _____ 5. $(-3 - 4i)(-3 + 4i) = 25$.

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. One | B. Two | C. Zero |
| D. Standard | E. Turning Point | F. Slope-Intercept |
| G. Vertex | H. Minimum | I. Maximum |
| J. Multiplication | K. Composition | L. Circle |

- _____ 6. $P(x) = a(x - h)^2 + k$ is called the _____ form of the quadratic function P .
- _____ 7. The equation $4x^2 + 2x - 6 = 0$ has _____ real solutions.
- _____ 8. The operation “ $\circ$ ” as in $f \circ g$ is called _____.
- _____ 9. The vertex of the parabola $y = -x^2 + 9$ represents the _____ value of the quadratic function.
- _____ 10. The parabola $y = x^2 + 4x + 6$ has _____ x -intercepts.

Part III: Multiple Choice [4 points each]

Write the letter corresponding to the appropriate answer in the space provided.

_____ **11.** Let $f(x) = x^2 + 2x$ and $g(x) = x - 1$. Find a formula for $(fg)(x)$.

A. $x^2 - 3$

B. $x^2 + 3x - 1$

C. $x^2 + x + 1$

D. $x^3 + x^2 - 2x$

_____ **12.** Solve the inequality: $|x - 3| < 2$.

A. $(1, 5)$

B. $(-\infty, 1) \cup (5, \infty)$

C. $[1, 5]$

D. $(-\infty, 1] \cup [5, \infty)$

_____ **13.** What is the complex conjugate of the number $z = 5 + 2i$?

A. $-5 + 2i$

B. $5 - 2i$

C. $-5 - 2i$

D. $5 + 2i$

_____ **14.** Perform the operation and completely simplify: $(3 - i)(2 + 3i)$.

A. $9 + 7i$

B. $6 + 4i$

C. $9 - 7i$

D. $6 - 4i$

_____15. Identify the vertex of the parabola $P(x) = 3x^2 - 5$

A. $(0, 5)$

B. $(3, -5)$

C. $(0, -5)$

D. $(-5, 0)$

_____16. Solve the equation: $x^2 - 4x + 5 = 0$.

A. $x = -2 \pm i$

B. $x = -3, -1$

C. $x = 2 \pm i$

D. $x = 1, 3$

_____17. Solve the equation: $x^2 - 5x + 4 = 0$.

A. $x = \frac{5}{2} \pm \frac{3}{2}i$

B. $x = -1, -4$

C. $x = 1, 4$

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

_____18. Solve the equation: $2x^2 + 12x - 8 = 0$.

A. $x = -3 \pm \sqrt{13}$

B. $x = -2, 8$

C. $x = -8, 2$

D. $x = -3 \pm i\sqrt{13}$

_____ **19.** Solve the equation: $|3x - 3| + 3 = -3$.

A. $x = -1, 3$

B. $x = -3, 1$

C. $-1 < x < 3$

D. No Solution

_____ **20.** Solve the equation: $|x - 5| - 5 = 5$

A. $x = -5, 15$

B. $x = -15, 5$

C. $-5 < x < 15$

D. No Solution

_____ **21.** Find the y -intercept of the parabola: $y = 2(x - 3)^2 - 15$.

A. $(3, -15)$

B. $(0, 3)$

C. $(0, -15)$

D. None

_____ **22.** Find the x -intercepts of the parabola: $y = 2(x + 1)^2 - 2$.

A. $(-1, -2)$

B. $(0, -2), (0, 0)$

C. $(-2, 0), (0, 0)$

D. None

23–26. For problems **23** through **26**, consider the functions

$$f(x) = x^2 + 1 \quad \text{and} \quad g(x) = \sqrt{x + 1}.$$

_____ **23.** Find a formula for $g \circ f$.

A. $\sqrt{x^2 + 2}$

B. $x + \sqrt{2}$

C. $x + 2$

D. $\sqrt{x^2 + 1} + 1$

_____ **24.** Find a formula for $f \circ g$.

A. $\sqrt{x^2 + 2}$

B. $x + \sqrt{2}$

C. $x + 2$

D. $\sqrt{x^2 + 1} + 1$

_____ **25.** What is the domain of $g \circ f$?

A. $-\sqrt{2} < x < \sqrt{2}$

B. All real numbers

C. $[-1, \infty)$

D. $(-1, \infty)$

_____ **26.** What is the domain of $f \circ g$?

A. $-\sqrt{2} < x < \sqrt{2}$

B. All real numbers

C. $[-1, \infty)$

D. $(-1, \infty)$

_____ **27.** Perform the operation and simplify completely: $\frac{2+i}{4-3i}$.

A. $1 + 2i$

B. $\frac{1}{5} + \frac{2}{5}i$

C. $5 + 10i$

D. $\frac{8}{25} + \frac{13}{25}i$

_____ **28.** Perform the operation and simplify completely: $(2+i)(2-i)$.

A. $5i$

B. 5

C. $4 - i$

D. $4 + 4i$

_____ **29.** Reduce: i^{425} .

A. i

B. 1

C. $-i$

D. -1

_____ **30.** The absolute value of a complex number $z = a + bi$ is defined to be the number

$$|z| = |a + bi| = \sqrt{(a + bi)(a - bi)}.$$

Find $|12 - 5i|$.

A. 7

B. 17

C. 13

D. $5 - 12i$

Part IV: Short Answer [5 points each]

Show enough work. Clearly mark your final answers. Partial credit given when deserved.

- 31.** Consider the quadratic function $f(x) = 3x^2 - 12x + 6$. Find the x -intercepts, if any. Clearly mark your final answer.

- 32.** Find and completely simplify the difference quotient for the function

$$f(x) = 2x^2 - 3x.$$

You must show work to receive credit.