Name: Key

MA131/135: College Algebra
Instructor: Justin Ryan
Midterm Exam 2—Sections 2.4–3.3

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.*

F 1. The vertex of the parabola given by $y = 3x^2 - 14x - 5$ is the maximum of the function.

T 2. Real numbers are also complex numbers.

T 3. The number $z = \sqrt{-25}$ is pure imaginary.

T 4. The inequality $x^2 + 6x + 9 < 0$ has no real solutions.

T 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. No
D.	E.	F.
G. Vertex	H.	I. Maximum
J.	K. Composition	L.

G 6. $P(x) = a(x-h)^2 + k$ is called the _____ form of the quadratic function P.

B 7. The equation $4x^2 + 2x - 6 = 0$ has _____ real solutions.

K 8. The operation "$\circ$" as in $f \circ g$ is called _____.

I 9. The vertex of the parabola $y = -x^2 + 9$ represents the _____ value of the function.

C 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.

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

A. **B.**

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

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

A. $(1, 5)$ **B.**

C. **D.**

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

A. **B.** $5 - 2i$

C. **D.**

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

A. $9 + 7i$ **B.**

C. **D.**

C 15. Identify the vertex of the parabola $P(x) = 3x^2 - 5$.

A. B.

C. $(0, -5)$ D.

C 16. Solve the equations: $x^2 - 4x + 5 = 0$.

$(x-2)^2 = -1$

$x = 2 \pm i$

A. B.

C. $x = 2 \pm i$ D.

C 17. Solve the equation: $x^2 - 5x + 4 = 0$.

A. B.

C. $x = 1, 4$ D.

A 18. Solve the equation: $2x^2 + 12x - 8 = 0$.

$2(x^2 + 6x + 9 - 4 - 9) = 0$

$(x+3)^2 = 26$

$x = -3 \pm \sqrt{26}$

A. $-3 \pm \sqrt{26}$ B.

C. D.

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

$|3x-3|=-6$ impossible!

A. B.

C. D. No Solution.

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

$x-5=10$ $\quad x-5=-10$

$x=15$ $\quad x=-5$

A. $x=-5, 15$ B.

C. D. No Solution.

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

A. B. $(0,-3)$

C. D. None.

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

A. B.

C. $x=-2,0$ D. None.

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

A 23. Find $g \circ f$.

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

C. D.

C 24. Find $f \circ g$.

A. B.

C. $x+2$ D.

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

A. B. $\mathbb{R}$

C. D.

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

A. B.

C. $[-1, \infty)$ D.

B 27. Perform the operation: $\frac{2+i}{4-3i}$.

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

C. D.

$\frac{(2+i)(4+3i)}{25} = \frac{5+10i}{25}$

$= \frac{1}{5}+\frac{2}{5}i$

B 28. Perform the operation: $(2+i)(2-i)$.

A. B. 5

C. D.

A 29. Reduce: i^{425}.

A. i B.

C. D.

C 30. The absolute value of a complex number $z=a+bi$ is defined to be the number $|z| = \sqrt{(a+bi)(a-bi)}$. Find $|12-5i|$.

A. B.

C. 13 D.

Part IV: Short Answer [5 points each]

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

31. For the function $f(x) = 3x^2 - 12x + 6$, ~~find the vertex, x- and y-intercepts, and the axis of symmetry. Show all work and label each answer.~~ Find the x-intercepts, if any.

$3x^2 - 12x + 6 = 0$

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

$(x-2)^2 - 2 = 0$

$x = 2 \pm \sqrt{2}$

So the x-intercepts are

$(2+\sqrt{2}, 0)$ and $(2-\sqrt{2}, 0)$.

32. Find and simplify the difference quotient for $f(x) = 2x^2 - 3x$. You must show enough work!

$f(x+h) = 2(x+h)^2 - 3(x+h)$

$= 2(x^2 + 2xh + h^2) - 3x - 3h$

$= 2x^2 - 3x + 4xh + 2h^2 - 3h$

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

$\frac{f(x+h) - f(x)}{h} = \frac{h(4x - 3 + 2h)}{h}$

So $DQ = \frac{f(x+h) - f(x)}{h} = 4x - 3 + 2h$