Name: Date:
Teacher: Class/Period:

1) What is the complex conjugate of $7 + \sqrt{-8}$?

A. $7 + 4i\sqrt{2}$

B. $7 - 4i\sqrt{2}$

C. $7 + 2i\sqrt{2}$

D. $7 - 2i\sqrt{2}$

2) What is the complex conjugate of $\frac{1}{2} - 2i$?

A. $2 - 2i$

B. $2 - \frac{1}{2}i$

C. $\frac{1}{2}i - 2$

D. $\frac{1}{2} + 2i$

3) One of the roots of the quadratic equation $x^2 - 4x + 5 = 0$ is $2 + i$. What is the other root?

A. $-2 + i$

B. $-2 - i$

C. $i - 2$

D. $2 - i$

4) What is the complex conjugate of $\frac{2}{i - 3}$?

A. $i + 3$

B. $-i + 3$

C. $-\frac{3 - i}{5}$

D. $-\frac{3 - i}{4}$

5) Simplify $(2\sqrt{5})^2 - (3 - \sqrt{-6})(3 + \sqrt{-6})$.

A. 1

B. 5

C. 11

D. 17

6) What is the product of $(4 - 3i)$ and $(-7 - 2i)$?

A. $-23 + 13i$

B. $-23 - 29i$

C. $-34 + 13i$

D. $-34 - 29i$

7) If $c - d = 7$ and $c = 3 - 4i$, what is d ?

A. $-4 - 4i$

B. $-4 + 4i$

C. $4 - 4i$

D. $4 + 4i$

8) What is the sum of $2i$, $-5 - 6i$, and 7 ?

A. $7 - 9i$

B. $2 - 4i$

C. $2 + 8i$

D. $7 + i$

9) Let m and n be real numbers. Find the real and imaginary parts of $(3 + mi)(n - 2i)$.

A. Real: $(3n - 2m)$; Imaginary: $(6 - mn)i$

B. Real: $(3n - 2m)$; Imaginary: $(mn - 6)i$

C. Real: $(3n + 2m)$; Imaginary: $(mn - 6)i$

D. Real: $3n$; Imaginary: $2mi$

10) Rationalize $\frac{1+i}{1-i}$.

A. -1

B. 1

C. $-i$

D. i

11) Write $\frac{9-i^2}{3-i}$ in standard form.

A. $3 - i$

B. $3 + i$

C. $\frac{10}{3}$

D. $\frac{8}{3}$

12) What is the first step in simplifying $\frac{6-4i}{-5+3i}$?

A. Multiply the fraction by $\frac{6+4i}{6+4i}$.

B. Multiply the fraction by $\frac{-5-3i}{-5-3i}$.

C. Multiply the fraction by $6 + 4i$.

D. Multiply the fraction by $-5 - 3i$.

13) Completely simplify $\frac{5}{2-i}$.

A. $-\frac{2+i}{5}$

B. $\frac{5}{2} - 5i$

C. $2 + i$

D. $2 + 5i$

14) What is the domain of $f(x) = \sqrt{\frac{x-2}{x^2-4}}$?

A. $\{x \mid x \neq 2\}$

B. $\{x \mid x \neq -2 \text{ and } x \neq 2\}$

C. $\{x \mid x > -2 \text{ and } x \neq 2\}$

D. $\{x \mid x > -2\}$

15) If $f(x) = \sqrt{x} - 2x$ and $g(x) = \frac{x}{5-x}$, what is $f(g(x))$?

A. $\sqrt{\frac{x}{5-x}} - \frac{2x}{5-x}$

B. $\frac{\sqrt{x}-2x}{5-\sqrt{x}+2x}$

C. $\frac{\sqrt{x}-2x}{5-x}$

D. $\frac{x\sqrt{x}-2x^2}{5-x}$

16) Which of the following intervals best represents the range of $f(x) = \log_6(3x)$ over the domain [2,12] ?

A. [0.39,1.39]

B. [1.00,2.00]

C. [1.00,6.00]

D. [1.16,4.16]

17) Consider the functions $f(x) = 3\sqrt{\frac{x}{2}}$ and $g(x) = 4x^2$.
Find and simplify $(g \circ f)(x)$ for $x > 0$.

A. $\frac{4}{3}\sqrt{\frac{x^3}{8}}$

B. $3\sqrt{2}x$

C. $12x^2\sqrt{\frac{x}{2}}$

D. $18x$

18) Let $P(x) = 2x^3 - 2x^2 + 3$ and let $Q(x)$ be a polynomial function with integer coefficients, such that the composition function $(P \circ Q)(x)$ is a polynomial of degree 15. If it can be determined, what is the degree of $Q(x)$?

A. 5

B. 12

C. 15

D. The degree of $Q(x)$ cannot be determined from the given information.

19) Express the difference $(4 + 3i)^2 - (7 + 2i)$ in the form $a + bi$, where a and b are real numbers and $i^2 = -1$. Show all work. What is the square of that result?

20) Consider the complex numbers $q = 3 - i$ and $r = 5 + 2i$.

A. What is $r - 3q$ expressed in $a + bi$ form, where a and b are real values? Show your algebraic work.

B. What is $q \bullet r$ expressed in $a + bi$ form? Show your algebraic work.

C. What is $\frac{q}{r}$ expressed in $a + bi$ form? Show your algebraic work, and explain the approach you used to find your answer.

21) Consider the real-valued functions $f(x) = x^2 - 6$ and $g(x) = 2x - 3$.

A. What are the domain and range of each function? Explain how you determined your answers.

B. Find $f(g(x))$. Show your algebraic work, and explain the approach you used to find your answer.

C. What are the domain and range of $f(g(x))$? Show your algebraic work, and explain the approach you used to find your answer.

22) Consider the functions $f(x) = 1 + \sqrt{7 - 2x}$ and $g(x) = \frac{1}{3 - \sqrt{x + 5}}$.

A. What is the exact value of $f(-10)$? Simplify your answer completely. Show your work algebraically, and explain the approach you used to find your answer.

B. What is the domain of $g(x)$? Explain how you determined your answer.

C. Simplify $f(x) \bullet g(x)$ such that there are no square roots in the denominator of the expression. Show your work algebraically.

23) Consider the logarithmic function $y = -\log_5(x - 2) + 3$.

A. What is the domain of this logarithmic function? Explain how you found your answer without using the graph from your calculator.

B. What is the range of this logarithmic function? Explain your answer using transformations of the graph $y = \log_5 x$.

C. Convert this equation to an exponential function with x in terms of y. Show your work algebraically, and explain how you found your answer step-by-step.

Please use the space below to write your response(s) to the writing assignment provided by your teacher. If there are multiple tasks to the question, please clearly label the number or letter of each task in the column to the left of your answers. If you need additional pages for your response, your teacher can provide them.

Please write the name of the writing assignment here: _____

Task

QualityCore™

Reference Sheet for the QualityCore™ **Algebra II End-of-Course Assessment**

Equations of a Line

Standard Form	$Ax + By = C$	A, B, and C are constants with A and B not both equal to zero.
Slope-Intercept Form	$y = mx + b$	(x_1,y_1) is a point. m = slope b = y-intercept
Point-Slope Form	$y - y_1 = m(x - x_1)$	

Quadratics

Standard Form of a Quadratic Equation	$ax^2 + bx + c = 0$	a, b, and c are constants, where $a \neq 0$.
Quadratic Formula	$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$	

Conic Sections

Circle	$(x - h)^2 + (y - k)^2 = r^2$	center (h,k) r = radius	
Parabola	$y = a(x - h)^2 + k$	axis of symmetry $x = h$ directrix $y = k - \frac{1}{4a}$	vertex (h,k) focus $\left(h, k + \frac{1}{4a}\right)$
Parabola	$x = a(y - k)^2 + h$	axis of symmetry $y = k$ directrix $x = h - \frac{1}{4a}$	vertex (h,k) focus $\left(h + \frac{1}{4a}, k\right)$
Ellipse	$\frac{(x-h)^2}{a^2} + \frac{(y-k)^2}{b^2} = 1$	foci $(h \pm c, k)$ where $c^2 = a^2 - b^2$, center (h,k)	
Ellipse	$\frac{(y-k)^2}{a^2} + \frac{(x-h)^2}{b^2} = 1$	foci $(h, k \pm c)$ where $c^2 = a^2 - b^2$, center (h,k)	
Hyperbola	$\frac{(x-h)^2}{a^2} - \frac{(y-k)^2}{b^2} = 1$	foci $(h \pm c, k)$ where $c^2 = a^2 + b^2$, center (h,k)	
Hyperbola	$\frac{(y-k)^2}{a^2} - \frac{(x-h)^2}{b^2} = 1$	foci $(h, k \pm c)$ where $c^2 = a^2 + b^2$, center (h,k)	

Lines and Points

Slope	$m = \frac{y_2 - y_1}{x_2 - x_1}$	(x_1,y_1) and (x_2,y_2) are 2 points. m = slope M = midpoint d = distance
Midpoint	$M = \left(\frac{x_1 + x_2}{2}, \frac{y_1 + y_2}{2}\right)$	
Distance	$d = \sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2}$	

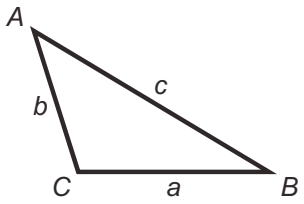
continued

Miscellaneous

Distance, Rate, Time	$D = rt$	D = distance r = rate t = time I = interest p = principal A = amount of money after t years n = number of times interest is compounded annually
Simple Interest	$I = prt$	
Compound Interest	$A = p\left(1 + \frac{r}{n}\right)^{nt}$	
Pythagorean Theorem	$a^2 + b^2 = c^2$	a and b = legs of right triangle c = hypotenuse

Laws of Sines and Cosines

Law of Sines	$\frac{\sin A}{a} = \frac{\sin B}{b} = \frac{\sin C}{c}$
Law of Cosines	$a^2 = b^2 + c^2 - 2bc \cos A$



Sequences, Series, and Counting

Arithmetic Sequence	$a_n = a_1 + (n - 1)d$	$a_n = n^{\text{th}}$ term n = number of the term d = common difference s_n = sum of the first n terms r = common ratio k = number of objects in the set m = number of objects selected
Arithmetic Series	$s_n = \frac{n}{2}(a_1 + a_n)$	
Geometric Sequence	$a_n = a_1(r^{n-1})$	
Geometric Series	$s_n = \frac{a_1 - a_1 r^n}{1 - r}$ where $r \neq 1$	
Combinations	${}_kC_m = C(k,m) = \frac{k!}{(k-m)!\,m!}$	
Permutations	${}_kP_m = P(k,m) = \frac{k!}{(k-m)!}$	

Circumference, Area, and Volume

Triangle	$A = \frac{1}{2}bh$	A = area b = base h = height r = radius C = circumference d = diameter V = volume B = area of base $\pi \approx 3.14$
Parallelogram	$A = bh$	
Trapezoid	$A = \frac{1}{2}(b_1 + b_2)h$	
Circle	$A = \pi r^2$ $C = \pi d$	
General Prism	$V = Bh$	
Right Circular Cylinder	$V = \pi r^2 h$	
Pyramid	$V = \frac{1}{3}Bh$	
Right Circular Cone	$V = \frac{1}{3}\pi r^2 h$	
Sphere	$V = \frac{4}{3}\pi r^3$	

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Answer Key

1) D
2) D
3) D
4) C
5) B
6) C
7) A
8) B
9) C
10) D
11) B
12) B
13) C
14) C
15) A
16) B
17) D
18) A

19) **Answer:**
$(4 + 3i)(4 + 3i) = 16 + 12i + 12i - 9$, or $7 + 24i$.
$(7 + 24i) - (7 + 2i) = 0 + 22i$.
$(0 + 22i)^2 = -484$.

Scoring Criteria:

20)

A 4-point response may include, but is not limited to, the following points:

A. **Correct difference:** $-4+5i$

Appropriate work leading to the answer:
$5+2i-3(3-i)=5+2i-9+3i=\bar{}4+5i$

B. **Correct product:** $17+i$

Appropriate work leading to the answer:
$(3-i)(5+2i)=15+6i-5i-2i^2=15+i-2(-1)=15+i+2=17+i$

C. **Correct quotient:** $\frac{13}{29}-\frac{11}{29}i$

Appropriate work leading to the answer:
$$\frac{(3-i)}{(5+2i)}\bullet\frac{(5-2i)}{(5-2i)}=\frac{15-6i-5i+2i^2}{25-10i+10i-4i^2}=\frac{15-11i+2(-1)}{25-4(-1)}=\frac{13-11i}{29}$$

Explanation of the approach used to find the answer: First, I identified the complex conjugate of the denominator. I changed the imaginary part of the denominator from positive to negative: $5+2i\rightarrow 5-2i$. Then, I multiplied the numerator and denominator by the complex conjugate using FOIL. Then, I substituted −1 for i^2. Finally, I added like terms and put my answer in $a+bi$ form.

Rubric:

4 **A response at this level provides evidence of thorough knowledge and understanding of the subject matter.**

- The response addresses all parts of the question or problem correctly.
- The response demonstrates efficient and accurate use of appropriate procedures.
- The explanation of strategies used in the response shows evidence of a good understanding of mathematical concepts and principles, and it does not contain any misconceptions.
- The explanation in the response is clear and coherent.

3 **A response at this level provides evidence of competent knowledge and understanding of the subject matter.**

- The response addresses most parts of the question or problem correctly.
- The response includes some minor errors but generally uses appropriate procedures accurately.
- The explanation of strategies used in the response shows some evidence of a good understanding of mathematical concepts and principles, and it contains few, if any, misconceptions.
- The explanation in the response is mostly clear and coherent.

2 **A response at this level provides evidence of a basic knowledge and understanding of the subject matter.**

- The response addresses some parts of the question or problem correctly.
- The response includes a number of errors but demonstrates some use of appropriate procedures.
- The explanation of strategies used in the response shows a little evidence of understanding of mathematical concepts and principles, but it may contain some evidence of misconceptions.
- The explanation in the response is partially clear, but some parts may be difficult to understand.

1 **A response at this level provides evidence of minimal knowledge and understanding of the subject matter.**

- The response addresses a few parts of the problem correctly, but the response is mostly incorrect.
- The response includes inappropriate procedures or simple manipulations that show little or no understanding of correct procedures.
- The explanation of strategies used in the response shows little or no evidence of understanding of mathematical concepts and principles, and it may contain evidence of significant misconceptions.
- Many parts of the explanation are difficult to understand.

0 **A response at this level is not scorable.** The response is off-topic, blank, hostile, or otherwise not scorable.

Scoring Criteria:

21) A 4-point response may include, but is not limited to, the following points:

A. **Correct domain for *f*(*x*):** All real numbers

Correct range for *f*(*x*): $y \geq -6$

Correct domain for *g*(*x*): All real numbers

Correct range for *g*(*x*): All real numbers

Explanation of how the answer was determined: The domain is all real numbers because any number can be substituted for x in $f(x)$. The range is $y \geq -6$ because $f(x)$ is a parabola with the vertex at $(0,-6)$. Since the coefficient on the x^2 term is positive, the parabola opens upward, and the range will be all numbers greater than or equal to the y-value of the vertex, -6. The domain is all real numbers because any number can be substituted for x in $g(x)$. The range is all real numbers because $g(x)$ is a linear function and each y-value is used in a linear function.

B. **Correct expression for *f*(*g*(*x*)):** $4x^2 - 12x + 3$

Appropriate work leading to the answer:

$$f\left(g(x)\right) = f(2x-3) = (2x-3)^2 - 6 = 4x^2 - 12x + 9 - 6 = 4x^2 - 12x + 3$$

Explanation of the approach used to find the answer: I substituted in $2x-3$ for $g(x)$. Then, I substituted $2x-3$ for each x in $g(x)$. I squared $2x-3$ using FOIL, then simplified and subtracted 6.

C. **Correct domain for *f*(*g*(*x*)):** All real numbers

Correct range for *f*(*g*(*x*)): $y \geq -6$

Appropriate work leading to the answer:

$$x = \frac{-(-12)}{2(4)} = \frac{12}{8} = \frac{3}{2}$$

$$f\left(g(x)\right) = f\left(g\left(\frac{3}{2}\right)\right) = 4\left(\frac{3}{2}\right)^2 - 12\left(\frac{3}{2}\right) + 3 = 4\left(\frac{9}{4}\right) - 18 + 3 = 9 - 15 = -6$$

Explanation of the approach used to find the answer: The domain is all real numbers because any number can be substituted for x in $f(g(x))$. Also, the domain of $g(x)$, the inner function, is all real numbers. The range is $y \geq -6$ because $f(g(x))$ is a parabola with its vertex at $\left(\frac{3}{2}, -6\right)$. Since the coefficient on the x^2 term is positive, the parabola opens upward, and the range will be all numbers greater than or equal to the y-value of the vertex, -6.

Rubric:

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Scoring Criteria:

22) A 4-point response may include, but is not limited to, the following points:

A. **Correct value:** $1+3\sqrt{3}$

Appropriate work needed to find the answer:
$f(-10)=1+\sqrt{7-2(-10)}=1+\sqrt{7+20}=1+\sqrt{27}=1+\sqrt{9}\sqrt{3}=1+3\sqrt{3}$

Explanation of the approach used to find the answer: I substituted −10 for x in $f(x)$. I simplified the expression under the radical to 27. Then, I broke 27 into 9, the highest perfect square that is a factor of the expression, and 3. Then, I simplified $\sqrt{9}$ as 3.

B. **Correct domain:** $\{x : x \geq -5, \text{ except } x = 4\}$

Explanation of how the answer was determined: To find the domain, I needed to determine when the denominator equaled zero and when the expression under the radical sign was negative. First, I set the denominator equal to zero. I added $\sqrt{x+5}$ to both sides of the equation, and squared both sides. I subtracted 5 from both sides of the equation. The denominator equaled zero when x was 4, so I eliminated 4 from the domain of the function. Then, I set up an inequality to show when the expression under the radical was less than zero (negative). I subtracted 5 from both sides of the inequality. The expression under the radical was negative when $x < -5$, so I eliminated $x < -5$ from the domain. Using both sets of exclusions, I found that the domain had to be greater than or equal to -5 except for the case when $x = 4$.

C. **Correct expression:** $\dfrac{3+\sqrt{x+5}+3\sqrt{7-2x}+\sqrt{-2x^2-3x+35}}{-x+4}$

Appropriate work needed to find the answer:

$$f(x) \bullet g(x) = \left(1+\sqrt{7-2x}\right) \bullet \left(\frac{1}{3-\sqrt{x+5}}\right) = \frac{1+\sqrt{7-2x}}{3-\sqrt{x+5}}$$

$$\frac{\left(1+\sqrt{7-2x}\right)}{\left(3-\sqrt{x+5}\right)} \bullet \frac{\left(3+\sqrt{x+5}\right)}{\left(3+\sqrt{x+5}\right)} = \frac{3+\sqrt{x+5}+3\sqrt{7-2x}+\sqrt{(7-2x)(x+5)}}{9+3\sqrt{x+5}-3\sqrt{x+5}-\sqrt{(x+5)^2}} =$$

$$\frac{3+\sqrt{x+5}+3\sqrt{7-2x}+\sqrt{-2x^2-3x+35}}{9-(x+5)}$$

$$\frac{3+\sqrt{x+5}+3\sqrt{7-2x}+\sqrt{-2x^2-3x+35}}{-x+4}$$

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Scoring Criteria:

23)

A 4-point response may include, but is not limited to, the following points:

A. **Correct domain:** $x > 2$

Explanation of how the answer was found: For the domain, I can only include values of x where $(x-2)$ is a positive number. Any value greater than 2 will result in a positive number.

B. **Correct range:** All real numbers

Explanation of the answer: The range of $y = \log_5 x$ is all real numbers. Shifting the function 2 to the right, reflecting it across the x-axis, and shifting it up 3 does not change the range.

C. **Correct exponential equation:** $x = 5^{3-y} + 2$

Appropriate work needed to find the answer:

$y - 3 = -\log_5(x-2)$

$3 - y = \log_5(x-2)$

$x - 2 = 5^{3-y}$

Explanation of how the answer was found: First, I subtracted 3 from both sides of the equation. Then, I multiplied both sides of the equation by −1 to get rid of the negative in front of the logarithmic expression. Then, I used the base of the logarithmic expression as the base of the exponent. The side without the logarithmic expression became the exponent. I moved the expression in parentheses to the other side of the equation. Then, I added 2 to both sides.

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