Algebra 2
Final Exam

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MATH

Algebra 2 Final Exam

This exam is comprehensive over the entire course and includes 12 questions. You have 60 minutes to complete the exam.

The exam is worth 100 points. The 8 multiple choice questions are worth 5 points each (40 points total) and the 4 free response questions are worth 15 points each (60 points total).

Mark your multiple choice answers on this cover page. For the free response questions, show your work and make sure to circle your final answer.

1. (5 pts)	A	B	C	D	E
2. (5 pts)	A	B	C	D	E
3. (5 pts)	A	B	C	D	E
4. (5 pts)	A	B	C	D	E
5. (5 pts)	A	B	C	D	E
6. (5 pts)	A	B	C	D	E
7. (5 pts)	A	B	C	D	E
8. (5 pts)	A	B	C	D	E

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1. **(5 pts)** At a local market, a woman sells a 4-pack of homemade organic soap for $\$18$. Her markup is $72\,\%$. What is her cost to make the 4-pack of soap?

A $\$0.72$

B $\$4.72$

C $\$10.47$

D $\$7.53$

E $\$72.00$

2. **(5 pts)** Rationalize the denominator of the rational expression.

$$\frac{4-\sqrt{2}}{\sqrt{2}+3}$$

A $\dfrac{14+7\sqrt{2}}{7}$

B $\dfrac{14-7\sqrt{2}}{7}$

C $-\dfrac{14-7\sqrt{2}}{7}$

D $\dfrac{14-7\sqrt{2}}{-7}$

E $\dfrac{-14-7\sqrt{2}}{7}$

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3. **(5 pts)** Solve $\sqrt{x^2 - 10x - 16} = x - 4$.

A	$x = -16$	C	$x = 4$	E	$x = 0$
B	$x = 2$	D	$x = -2$		

4. **(5 pts)** If you sit in a hammock, it will stretch. The amount of stretch varies directly with the amount of weight in the hammock. If a person weighs 120 pounds, the hammock will stretch 4 inches. What distance will a person who weighs 135 pounds stretch the hammock?

A	1	C	2	E	4.5
B	1.5	D	4		

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5. **(5 pts)** Factor $8x^2 - 10x + 3$.

A $(2x - 1)(4x - 3)$

B $(2x - 1)(4x + 3)$

C $(2x + 1)(4x - 3)$

D $(4x + 3)(2x + 1)$

E $(4x - 3)(2x + 1)$

6. **(5 pts)** Find $f(g(x))$ if $f(x) = x^2 + 4x - 7$ and $g(x) = 4x + 3$.

A $2(8x^2 - 20x + 7)$

B $2(8x^2 + 20x - 7)$

C $2(8x^2 - 20x - 7)$

D $2(8x^2 + 20x + 7)$

E $-2(8x^2 + 20x + 7)$

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7. **(5 pts)** Simplify $\log_2(1/8) + \log_2 16$.

A 2

B 16

C 1

D 64

E 4

8. **(5 pts)** Find the inverse of $y = (x - 2)/3$.

A $y = 3x + 2$

B $y = 3x - 2$

C $y = 2x + 3$

D $y = x^2 + 3x + 2$

E $y = \dfrac{x - 3}{2}$

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9. **(15 pts)** Solve the system of equations.

$$y = x^2 - x - 6$$

$$y - 2x = -2$$

10. **(15 pts)** Simplify the imaginary expression.

$$\frac{3 + 5i}{3i^3 + 2i^6}$$

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11. **(15 pts)** If Julie pedals her bicycle at 20 mph for 1.5 hours, how far did she travel?

12. **(15 pts)** What is the domain of $f \circ g$?

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

$$g(x) = \frac{1}{x}$$

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Algebra 2
Final Exam Solutions

Algebra 2 Final Exam Answer Key

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2. (5 pts)	A	■	C	D	E
3. (5 pts)	■	B	C	D	E
4. (5 pts)	A	B	C	D	■
5. (5 pts)	■	B	C	D	E
6. (5 pts)	A	B	C	■	E
7. (5 pts)	A	B	■	D	E
8. (5 pts)	■	B	C	D	E

9. (15 pts) $(4,6)$ and $(-1,-4)$

10. (15 pts) $\dfrac{-21-i}{13}$

11. (15 pts) 30 miles

12. (15 pts) $f(g(x))=\dfrac{4x}{1+2x}$ with $x \neq -1/2,\ 0$

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Algebra 2 Final Exam Solutions

1. C. If the woman spends x to make the soap and marked it up by 72%, then the price she's selling it to customers for is 1.72 times the cost to make it.

$$1.72x = \$18$$

$$\frac{1.72x}{1.72} = \frac{\$18}{1.72}$$

$$x = \$10.47$$

It costs the woman $\$10.47$ to make a 4-pack of soap. Her markup is 72%, or $\$10.47(0.72) = \$7.53$, and she sells the soap for $\$18$.

2. B. Multiply by the conjugate of the denominator.

$$\frac{4-\sqrt{2}}{\sqrt{2}+3}$$

$$\frac{4-\sqrt{2}}{\sqrt{2}+3} \cdot \frac{\sqrt{2}-3}{\sqrt{2}-3}$$

Use FOIL to multiply the numerators and denominators.

$$\frac{(4-\sqrt{2})(\sqrt{2}-3)}{(\sqrt{2}+3)(\sqrt{2}-3)}$$

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$$\frac{4\sqrt{2} - 12 - 2 + 3\sqrt{2}}{2 - 3\sqrt{2} + 3\sqrt{2} - 9}$$

$$\frac{-14 + 7\sqrt{2}}{-7}$$

$$\frac{14 - 7\sqrt{2}}{7}$$

3. A. Square both sides of the equation.

$$\sqrt{x^2 - 10x - 16} = x - 4$$

$$(\sqrt{x^2 - 10x - 16})^2 = (x - 4)^2$$

The square and square root will cancel on the left. Use FOIL to expand the right side of the equation.

$$x^2 - 10x - 16 = x^2 - 4x - 4x + 16$$

$$x^2 - 10x - 16 = x^2 - 8x + 16$$

Solve for x.

$$x^2 - x^2 - 10x - 16 = x^2 - x^2 - 8x + 16$$

$$-10x - 16 = -8x + 16$$

$$-2x - 16 = 16$$

$$-2x = 32$$

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$$x = -16$$

4. E. Direct variation is modeled by $x = ky$. If we let w be weight and d be distance, we can write $w = kd$. Plugging the pair $(d, w) = (4,120)$ into the direct variation equation gives

$$120 = k \cdot 4$$

$$k = 30$$

Plugging in the other value of w (135) and $k = 30$ gives

$$135 = 30d$$

$d = 4.5$ inches

5. A. Remember that the standard form of a quadratic expression is $ax^2 + bx + c$. For the equation $8x^2 - 10x + 3$, we identify $a = 8$, $b = -10$, and $c = 3$. Multiply $a \cdot c$ to get $8 \cdot 3 = 24$, then find factors of the result that combine to b. We'll make a table with all of the factors, and their sum.

Factors of 24	Sum
-1, -24	-25
-2, -12	-14
-3, -8	-11
-4, -6	-10

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We know $-4+-6=-10$, so they're the factors we're looking for. Now we'll divide each factor by a and reduce the fractions, if possible.

$$\frac{-4}{8}=\frac{-1}{2}$$

One factor of the quadratic is $(2x-1)$ because the denominator of the reduced fraction becomes the coefficient on x. Then we add or subtract the numerator depending on the sign (in this case we'll subtract since -1 was the numerator).

$$\frac{-6}{8}=\frac{-3}{4}$$

The other factor of the quadratic is $(4x-3)$ because the denominator of the reduced fraction becomes the coefficient on x. Then we add or subtract the numerator depending on the sign (in this case we'll subtract since -3 was the numerator).

$$(2x-1)(4x-3)$$

Use FOIL to check your work.

6. D. Substitute $4x+3$ for x into $f(x)$.

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

$$f(g(x))=(16x^2+24x+9)+(16x+12)-7$$

$$f(g(x))=16x^2+40x+14$$

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$$f(g(x)) = 2(8x^2 + 20x + 7)$$

7. C. Use these two rules to evaluate the expression.

$$\log_a x + \log_a y = \log_a xy$$

If $\log_a y = x$, then $a^x = y$.

Applying the first rule to the given expression gives

$$\log_2 \frac{1}{8} + \log_2 16$$

$$\log_2 \left(\frac{1}{8} \cdot 16\right)$$

$$\log_2 2$$

It's probably obvious from this that $\log_2 2 = 1$, but if not, use the second rule above. If we let $x = \log_2 2$, then

$$2^x = 2$$

$$x = 1$$

8. A. Switch x and y in the original equation.

$$y = \frac{x-2}{3}$$

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$$x = \frac{y-2}{3}$$

Solve for y.

$$3x = y - 2$$

$$3x + 2 = y$$

9. Use the second equation to solve for y.

$$y - 2x = -2$$

$$y = 2x - 2$$

Plug $y = 2x - 2$ into the first equation and solve for x.

$$y = x^2 - x - 6$$

$$2x - 2 = x^2 - x - 6$$

$$0 = x^2 - 3x - 4$$

$$0 = (x - 4)(x + 1)$$

$x = 4$ and $x = -1$

Plug $x = 4$ into the equation where we've already solved for y.

$$y = 2(4) - 2$$

$$y = 6$$

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Plug $x = -1$ into the equation where we've already solved for y.

$$y = 2(-1) - 2$$

$$y = -4$$

The solutions are

$(4,6)$ and $(-1,-4)$

10. Simplify the powers of i by remembering that $i^2 = -1$.

$$\frac{3+5i}{3i^3+2i^6}$$

$$\frac{3+5i}{3(-1)i+2(-1)(-1)(-1)}$$

$$\frac{3+5i}{-3i-2}$$

$$\frac{3+5i}{-2-3i}$$

Use the conjugate method to get the imaginary number out of the denominator.

$$\frac{3+5i}{-2-3i} \cdot \frac{-2+3i}{-2+3i}$$

$$\frac{(3+5i)(-2+3i)}{(-2-3i)(-2+3i)}$$

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Use the FOIL method to multiply the binomials in the numerator and denominator.

$$\frac{-6+9i-10i+15i^2}{4-6i+6i-9i^2}$$

$$\frac{-6-i+15i^2}{4-9i^2}$$

Plug in $i^2 = -1$.

$$\frac{-6-i+15(-1)}{4-9(-1)}$$

$$\frac{-21-i}{13}$$

11. We'll use the formula for distance.

Distance $=$ Rate $\times$ Time

$$D = RT$$

Julie's rate is 20 mph, and her time is 1.5 hours. Therefore,

$$\text{Distance} = 20\ \frac{\text{miles}}{\text{hour}} \times 1.5 \text{ hours}$$

$$\text{Distance} = \frac{20 \cdot 1.5 \text{ miles} \cdot \text{hour}}{\text{hour}}$$

$$\text{Distance} = \frac{30 \text{ miles} \cdot \text{hour}}{\text{hour}}$$

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Distance $= 30$ miles

12. First, find the domain of $g(x)$. The expression $1/x$ is undefined if the denominator is 0. That means $x = 0$ isn't in the domain of $g(x)$. Therefore, the domain of $g(x)$ is all real numbers x such that $x \neq 0$.

The algebraic expression for the composite function is

$$f(g(x)) = \frac{4}{\frac{1}{x} + 2}$$

$$f(g(x)) = \frac{4}{\frac{1}{x} + 2\left(\frac{x}{x}\right)}$$

$$f(g(x)) = \frac{4}{\frac{1+2x}{x}}$$

$$f(g(x)) = 4 \cdot \frac{x}{1+2x}$$

$$f(g(x)) = \frac{4x}{1+2x}$$

The domain of a rational functions is all real numbers such that the denominator is not equal to 0.

$$1 + 2x \neq 0$$

$$2x \neq -1$$

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$$x \neq -\frac{1}{2}$$

Putting both exclusions together, the domain of the composite function is all real numbers except $-1/2$ and 0, so

$$f(g(x)) = \frac{4x}{1+2x} \text{ with } x \neq -1/2,\ 0$$

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W W W . K R I S T A K I N G M A T H . C O M

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7. (5 pts)	A	B	C	D	E
8. (5 pts)	A	B	C	D	E

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1. **(5 pts)** Two numbers a and b have a ratio of 6 to 5, and a difference of 6. What is the larger of the two numbers?

A 5

B 6

C 15

D 30

E 36

2. **(5 pts)** Simplify the expression, making sure to rationalize the denominator.

$$\sqrt{\frac{7}{36}}+\sqrt{\frac{13}{39}}$$

A $\sqrt{3}+\sqrt{7}$

B $6\sqrt{7}$

C $\frac{19\sqrt{3}}{6}$

D $\frac{2\sqrt{3}+\sqrt{7}}{6}$

E $\frac{2\sqrt{3}-\sqrt{7}}{6}$

3. **(5 pts)** Solve for x.

$$\frac{\frac{2}{5}}{\frac{3}{8}} = \frac{\frac{x}{9}}{\frac{5}{3}}$$

A	$x = 16$	C	$x = 2$	E	$x = -16$
B	$x = 5$	D	$x = -15$		

4. **(5 pts)** A computer is normally listed for $\$1,499$, but it's on sale for $\$1,200$. What is the percent markdown?

A	25%	C	20%	E	19.25%
B	24.92%	D	19.95%		

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5. **(5 pts)** Simplify the rational function to lowest terms.

$$\frac{(3x^3 + x^2 - 10x)(x^2 + x - 12)}{(2x^2 + 3x - 2)(3x^2 + 7x - 20)}$$

A $\dfrac{x-3}{2x-1}$

B $\dfrac{x(x-3)}{2x-1}$

C $\dfrac{x(2x-1)}{x-3}$

D $\dfrac{x(x-3)}{(2x-1)(x+4)}$

E $\dfrac{x(x+2)(x-3)}{(2x-1)(x+4)}$

6. **(5 pts)** Solve the equation for b.

$$\frac{c}{d} - \frac{a}{b} = \frac{e}{f}$$

A $a\left(\dfrac{c}{d} - \dfrac{e}{f}\right)$

B $a\left(\dfrac{e}{f} - \dfrac{c}{d}\right)$

C $\dfrac{a}{\frac{c}{d} - \frac{e}{f}}$

D $\dfrac{a}{\frac{e}{f} - \frac{c}{d}}$

E $\dfrac{\frac{c}{d} - \frac{e}{f}}{a}$

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7. **(5 pts)** Write the expression as a single logarithm.

$\log 8x + 3\log x - \log 2x^2$

A $\dfrac{\log 8x + 3}{2x^2}$

B $\log 4x^2$

C $\log 8x^6$

D $\log 24x - x^2$

E $\dfrac{\log 4 + 3}{x}$

8. **(5 pts)** Simplify the imaginary expression.

$4i^5 - \sqrt{-9} + 4i^7 - 12i^4 + \sqrt{-16} - 7i^6 + 5i^2$

A $7i - 10$

B $7i - 12$

C $-i - 12$

D $-i - 10$

E $i - 10$

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9. **(15 pts)** The product of the digits of a certain two-digit number is 24. Reversing the digits gives a number which is 45 greater than the original number. What is the original number?

10. **(15 pts)** Solve the equation for x.

$$\sqrt{5+4x} - x = 0$$

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11. **(15 pts)** What is the equation of a circle, in expanded form, with center at $(0,2)$ and diameter of 8 units?

12. **(15 pts)** An amusement park charges $\$40$ for children and $\$60$ for adults. On a particular day, $2{,}400$ people came to the amusement park. Write an equation that gives the number of children c that were at the amusement park that day, in terms of T, the total amount of money taken in by the park.

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Algebra 2
Final Exam Solutions

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4. (5 pts)	A	B	C	■	E
5. (5 pts)	A	■	C	D	E
6. (5 pts)	A	B	■	D	E
7. (5 pts)	A	■	C	D	E
8. (5 pts)	A	B	C	D	■

9. (15 pts) 38

10. (15 pts) $x = 5$

11. (15 pts) $x^2 + y^2 - 4y - 12 = 0$

12. (15 pts) $c = \dfrac{144{,}000 - T}{20}$

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1. E. Set up a proportion, by equation the ratio x/y to the ratio $7/13$, and solve for one of the variables in terms of the other.

$$\frac{a}{b} = \frac{6}{5}$$

Solve for a.

$$b \cdot \frac{a}{b} = \frac{6}{5} \cdot b$$

$$a = \frac{6}{5}b$$

Next, set up an equation for a and b using what we know about their difference.

$$a - b = 6$$

Substitute $a = \frac{6}{5}b$ and solve for b.

$$\frac{6}{5}b - b = 6$$

$$\frac{1}{5}b = 6$$

$$5 \cdot \frac{1}{5}b = 6 \cdot 5$$

$$b = 30$$

Now solve for a.

$$a = \frac{6}{5}b$$

$$a = \frac{6}{5} \cdot 30$$

$$a = 36$$

Since $a = 36$ and $b = 30$, $a = 36$ is the larger of the two numbers.

2. D. First simplify the fraction in the second radical to lowest terms.

$$\frac{13}{39} = \frac{1}{3}$$

Now we have

$$\sqrt{\frac{7}{36}} + \sqrt{\frac{1}{3}}$$

When we take the square root of a fraction, we can take the square roots of the numerator and denominator separately. Therefore, we can rewrite the expression as

$$\frac{\sqrt{7}}{\sqrt{36}} + \frac{\sqrt{1}}{\sqrt{3}}$$

Rewrite this by taking the square roots of any perfect squares.

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$$\frac{\sqrt{7}}{6}+\frac{1}{\sqrt{3}}$$

Now we need to find a common denominator. Since we have only two terms, we can do this by multiplying the numerator and denominator of each fraction by the denominator of the other fraction.

$$\frac{\sqrt{7}}{6}\left(\frac{\sqrt{3}}{\sqrt{3}}\right)+\frac{1}{\sqrt{3}}\left(\frac{6}{6}\right)$$

$$\frac{\sqrt{7}\sqrt{3}}{6\sqrt{3}}+\frac{1(6)}{6\sqrt{3}}$$

$$\frac{\sqrt{21}}{6\sqrt{3}}+\frac{6}{6\sqrt{3}}$$

Now that we have a common denominator, add the fractions.

$$\frac{6+\sqrt{21}}{6\sqrt{3}}$$

Rationalize the denominator.

$$\frac{6\sqrt{3}+\sqrt{21}\sqrt{3}}{6\sqrt{3}\sqrt{3}}$$

$$\frac{6\sqrt{3}+3\sqrt{7}}{18}$$

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$$\frac{2\sqrt{3}+\sqrt{7}}{6}$$

3. A. Instead of dividing by the fractions in the denominators, we can multiply by their reciprocals.

$$\frac{8}{3} \cdot \frac{2}{5} = \frac{x}{9} \cdot \frac{3}{5}$$

$$\frac{16}{15} = \frac{3x}{45}$$

Multiply both sides by 45.

$$45 \cdot \frac{16}{15} = 3x$$

Divide both sides by 3 to solve for x. Then multiply fractions to simplify.

$$x = \frac{45}{3} \cdot \frac{16}{15}$$

$$x = 16$$

4. D. A computer was originally $\$1499$, but the price is now reduced by $\$299(\$1499 - \$1200 = \$299)$. Use the proportion:

$$\frac{\text{Discount Amount}}{\text{Original Price}} = \frac{\text{Percent Markdown}}{100}$$

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$$\frac{299}{1{,}499} = \frac{x}{100}$$

$$100 \cdot \frac{299}{1{,}499} = x$$

$$\frac{29{,}900}{1{,}499} = x$$

$$x \approx 19.95$$

The percent markdown is approximately $19.95\,\%$.

5. B. Factor each polynomial completely.

$$\frac{(3x^3 + x^2 - 10x)(x^2 + x - 12)}{(2x^2 + 3x - 2)(3x^2 + 7x - 20)}$$

$$\frac{x(3x - 5)(x + 2)(x + 4)(x - 3)}{(2x - 1)(x + 2)(3x - 5)(x + 4)}$$

Simplify.

$$\frac{x(x - 3)}{2x - 1}$$

6. C. Rearrange the equation to get the term with b by itself on one side.

$$\frac{c}{d} - \frac{a}{b} = \frac{e}{f}$$

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$$\frac{c}{d} - \frac{a}{b} + \frac{a}{b} = \frac{e}{f} - \frac{e}{f} + \frac{a}{b}$$

$$\frac{c}{d} - \frac{e}{f} = \frac{a}{b}$$

Multiply both sides by b to get it out of the denominator.

$$b \cdot \left(\frac{c}{d} - \frac{e}{f}\right) = \frac{a}{b} \cdot b$$

$$b\left(\frac{c}{d} - \frac{e}{f}\right) = a$$

$$b = \frac{a}{\frac{c}{d} - \frac{e}{f}}$$

7. B. Apply the rules of logarithms to simplify.

$$\log_a x + \log_a y = \log_a xy$$

$$\log_a x - \log_a y = \log_a \frac{x}{y}$$

$$b \log_a x = \log_a x^b$$

Apply the third rule to the middle term.

$$\log 8x + 3 \log x - \log 2x^2$$

$$\log 8x + \log x^3 - \log 2x^2$$

Apply the first rule to the first two terms.

$$\log 8x \cdot x^3 - \log 2x^2$$

$$\log 8x^4 - \log 2x^2$$

Apply the second rule.

$$\log \frac{8x^4}{2x^2}$$

Simplify.

$$\log 4x^2$$

8. E. Start by rewriting the radicals, using the fact that $\sqrt{-1} = i$.

$$4i^5 - \sqrt{-9} + 4i^7 - 12i^4 + \sqrt{-16} - 7i^6 + 5i^2$$

$$4i^5 - \sqrt{9}\sqrt{-1} + 4i^7 - 12i^4 + \sqrt{16}\sqrt{-1} - 7i^6 + 5i^2$$

$$4i^5 - 3i + 4i^7 - 12i^4 + 4i - 7i^6 + 5i^2$$

Then we'll factor each expression of the form i^n with $n > 2$, using i and/or i^2 as factors.

$$4i^2i^2i - 3i + 4i^2i^2i^2i - 12i^2i^2 + 4i - 7i^2i^2i^2 + 5i^2$$

Replace each i^2 with -1.

$$4(-1)(-1)i - 3i + 4(-1)(-1)(-1)i - 12(-1)(-1)$$

$$+4i - 7(-1)(-1)(-1) + 5(-1)$$

$$4i - 3i - 4i - 12 + 4i + 7 - 5$$

$$i - 10$$

9. Let T and U be the tens digit and units digit, respectively, of the original number.

The value of the original number is

$$10T + U$$

Reversing the digits gives us a number whose value is

$$10U + T$$

The second number is 45 greater than the original number, so we can write

$$\text{original number} + 45 = \text{second number}$$

$$(10T + U) + 45 = (10U + T)$$

$$10T + U + 45 = 10U + T$$

$$9T - 9U + 45 = 0$$

Dividing through by 9 gives

$$T - U + 5 = 0$$

$$T = U - 5$$

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We know that the product of the digits is 24, so we'll substitute the expression we just found for T into the equation $T \cdot U = 24$, and then solve for U.

$$T \cdot U = 24$$

$$(U - 5) \cdot U = 24$$

$$U^2 - 5U = 24$$

$$U^2 - 5U - 24 = 0$$

$$(U - 8)(U + 3) = 0$$

$$U - 8 = 0 \text{ or } U + 3 = 0$$

$$U = 8 \text{ or } U = -3$$

Since the product of the two digits is positive, then both digits are positive and $U = 8$ is the only solution.

Our next step is to plug this value of U into the equation $T \cdot U = 24$, and then solve for T.

$$T \cdot U = 24$$

$$T \cdot 8 = 24$$

$$T = 3$$

The original number is 38. When we reverse the digits, we get 83, which is indeed 45 greater than 38: $83 = 38 + 45$.

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10. Add x to both sides.

$$\sqrt{5+4x} - x = 0$$

$$\sqrt{5+4x} - x + x = 0 + x$$

$$\sqrt{5+4x} = x$$

Square both sides.

$$(\sqrt{5+4x})^2 = x^2$$

The square and square root will cancel on the left.

$$5 + 4x = x^2$$

Get all of the terms to the right side and then factor to solve.

$$0 = x^2 - 4x - 5$$

$$0 = (x-5)(x+1)$$

$x = 5$ or $x = -1$

Check both possible solutions in the original equation.

Let $x = 5$.

$$\sqrt{5+4(5)} - 5 = 0$$

$$\sqrt{25} - 5 = 0$$

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$$5 - 5 = 0$$

$$0 = 0$$

Let $x = -1$.

$$\sqrt{5 + 4(-1)} - (-1) = 0$$

$$\sqrt{1} + 1 = 0$$

$$1 + 1 = 0$$

$$2 \neq 0$$

The only correct solution is $x = 5$.

11. The given information tells us that $h = 0$, $k = 2$, and $r = 4$. Substitute the values of h, k, and r into the equation $(x - k)^2 + (y - k)^2 = r^2$, then expand and simplify.

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

$$x^2 + y^2 - 4y + 4 = 16$$

$$x^2 + y^2 - 4y - 12 = 0$$

12. Let c be the number of children and a the number of adults. The total money taken in is

$$T = 40c + 60a$$

We also know that the total number of people who came to the amusement park is $2{,}400$, that is, $c + a = 2{,}400$. So $a = 2{,}400 - c$. Substituting $2{,}400 - c$ for a into the equation $T = 40c + 60a$ gives

$$T = 40c + 60(2{,}400 - c)$$

$$T = 40c + 144{,}000 - 60c$$

$$T = -20c + 144{,}000$$

Now solve for c.

$$T + 20c = 144{,}000$$

$$20c = 144{,}000 - T$$

$$c = \frac{144{,}000 - T}{20}$$

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W W W . K R I S T A K I N G M A T H . C O M

Algebra 2 Final Exam

This exam is comprehensive over the entire course and includes 12 questions. You have 60 minutes to complete the exam.

The exam is worth 100 points. The 8 multiple choice questions are worth 5 points each (40 points total) and the 4 free response questions are worth 15 points each (60 points total).

Mark your multiple choice answers on this cover page. For the free response questions, show your work and make sure to circle your final answer.

1. (5 pts)	A	B	C	D	E
2. (5 pts)	A	B	C	D	E
3. (5 pts)	A	B	C	D	E
4. (5 pts)	A	B	C	D	E
5. (5 pts)	A	B	C	D	E
6. (5 pts)	A	B	C	D	E
7. (5 pts)	A	B	C	D	E
8. (5 pts)	A	B	C	D	E

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1. **(5 pts)** If you deposit $\$200$ into a savings account that earns 2% simple interest annually, how much money will be in the account after 5 years?

A $\$200$

B $\$220$

C $\$20$

D $\$400$

E $\$2,200$

2. **(5 pts)** Simplify the expression.

$$\frac{y}{3x}+\frac{b}{yz^3}-\frac{c}{3y^2}$$

A $\dfrac{y+b-c}{x-yz^3}$

B $\dfrac{y^3z^3+3bxy-cxz^3}{3xy^2z^3}$

C $\dfrac{y+b-c}{3x+yz^3-3y^2}$

D $\dfrac{y^4z^3+3bxy^2-cxz^3}{3xy^2z^3}$

E $\dfrac{yb-c}{3xy^2z^3}$

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3. **(5 pts)** Red R varies inversely to Blue B. If $R = 4$ when $B = 1$, what will the number of Blue be when $R = 2$?

A $\frac{1}{2}$

B 1

C 2

D 4

E 8

4. **(5 pts)** Solve $\sqrt{x^2 + 5x - 14} = x + 2$.

A $x = 14$

B $x = 10$

C $x = \frac{18}{5}$

D $x = 18$

E $x = -10$

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5. **(5 pts)** Solve the system of equations.

$$2x + 3y - z = 17$$

$$3x - y + 2z = 11$$

$$x - 3y + 3z = -4$$

A $(5,2,-1)$

B $(5,2,1)$

C $(-5,-2,1)$

D $(-5,-2,-1)$

E $(-5,2,1)$

6. **(5 pts)** Factor $6x^2 - 11x + 4$.

A $(6x - 2)(x + 1)$

B $(6x + 2)(x - 1)$

C $(3x + 1)(2x + 4)$

D $(2x - 3)(3x - 4)$

E $(2x - 1)(3x - 4)$

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7. **(5 pts)** Find the inverse function of $y = \sqrt{x-2} + 3$.

A $y = x^2 + 11$

B $y = x^2 + 1$

C $y = x^2 - 6x + 11$

D $y = x^2 - x - 6$

E $y = x^2 - 11$

8. **(5 pts)** Simplify $\log_4 32 - \log_4 2$.

A 2

B 16

C 64

D 3

E 4

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9. **(15 pts)** Simplify the imaginary expression.

$$\frac{4-3i}{1i^2+2i^5}$$

10. **(15 pts)** Solve the system of equations.

$$(y-2)^2+x^2=9$$

$$y-x=-1$$

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11. **(15 pts)** Graph $f(x) = x^2 - 1$.

12. **(15 pts)** Find $f(g(x))$ if $f(x) = 3x^2 - 4x + 12$ and $g(x) = 2x - 5$.

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Algebra 2
Final Exam Solutions

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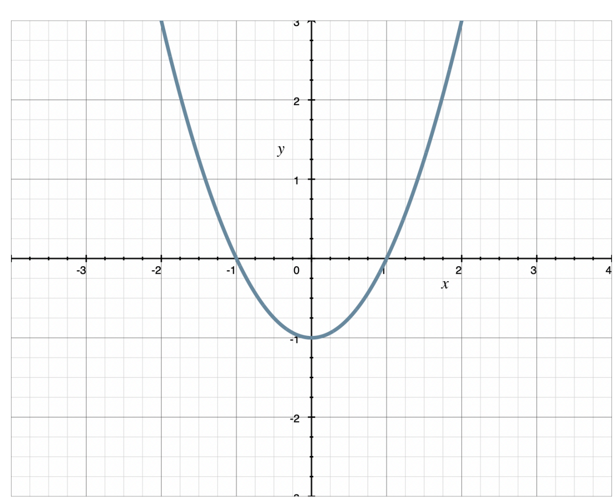
Algebra 2 Final Exam Answer Key

1. (5 pts)	A	■	C	D	E
2. (5 pts)	A	■	C	D	E
3. (5 pts)	A	B	■	D	E
4. (5 pts)	A	B	C	■	E
5. (5 pts)	■	B	C	D	E
6. (5 pts)	A	B	C	D	■
7. (5 pts)	A	B	■	D	E
8. (5 pts)	■	B	C	D	E

9. (15 pts) $-2-i$

10. (15 pts) $(0,-1)$ and $(3,2)$



11. (15 pts)

12. (15 pts) $f(g(x))=12x^2-68x+107$

Algebra 2 Final Exam Solutions

1. B. Calculate the interest using $I = prt$, $p = 200$, $r = 0.02$ (remember that $2\% = 0.02$), and $t = 5$.

$$I = (200)(0.02)(5)$$

$$I = 20$$

Now add the interest to the initial deposit of $\$200$.

$$\$200 + \$20$$

There is $\$220$ in the account after 5 years.

2. B. We need to find the common denominator, which will be $3xy^2z^3$. Multiply each term by whatever is required to make the denominator $3xy^2z^3$ (remember you can only multiply by a well chosen 1, which means that whatever you multiply on the bottom you need to also multiply on the top).

$$\frac{y}{3x} + \frac{b}{yz^3} - \frac{c}{3y^2}$$

$$\frac{y}{3x} \cdot \frac{y^2z^3}{y^2z^3} + \frac{b}{yz^3} \cdot \frac{3xy}{3xy} - \frac{c}{3y^2} \cdot \frac{xz^3}{xz^3}$$

$$\frac{y^3z^3}{3xy^2z^3} + \frac{3bxy}{3xy^2z^3} - \frac{cxz^3}{3xy^2z^3}$$

Now combine the fractions.

$$\frac{y^3z^3 + 3bxy - cxz^3}{3xy^2z^3}$$

3. C. Inverse variation means that the second variable is in the denominator. In other words, the number of red R will equal a constant divided by the number of Blue B.

$$r = \frac{k}{b}$$

Find k by plugging in 4 for r and 1 for b.

$$4 = \frac{k}{1}$$

$$k = 4$$

Find the number of blue when $r = 2$ by plugging 2 in for r and 4 in for k.

$$2 = \frac{4}{b}$$

Solve for b by multiplying both sides by b and dividing by 2.

$$2 \cdot b = \frac{4}{b} \cdot b$$

$$2b = 4$$

$$\frac{2b}{2} = \frac{4}{2}$$

$$b = 2$$

4. D. Square both sides.

$$\sqrt{x^2 + 5x - 14} = x + 2$$

$$\left(\sqrt{x^2 + 5x - 14}\right)^2 = (x + 2)^2$$

The square and square root will cancel on the left. Use FOIL to expand the right side of the equation.

$$x^2 + 5x - 14 = x^2 + 2x + 2x + 4$$

$$x^2 + 5x - 14 = x^2 + 4x + 4$$

Solve for x.

$$x^2 - x^2 + 5x - 14 = x^2 - x^2 + 4x + 4$$

$$5x - 14 = 4x + 4$$

$$5x - 4x - 14 = 4x - 4x + 4$$

$$x - 14 = 4$$

$$x - 14 + 14 = 4 + 14$$

$$x = 18$$

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5. A. Let's label the equations to make things more clear.

[1] $2x + 3y - z = 17$

[2] $3x - y + 2z = 11$

[3] $x - 3y + 3z = -4$

Start by eliminating z from equation [2] by multiplying [1] by 2.

$$2(2x + 3y - z = 17)$$

$$4x + 6y - 2z = 34$$

Then add this to [2].

$$4x + 6y - 2z + (3x - y + 2z) = 34 + 11$$

$$7x + 5y = 45$$

Next, eliminate z from equation [3] by multiplying [1] by 3.

$$3(2x + 3y - z = 17)$$

$$6x + 9y - 3z = 51$$

Then add this to [3].

$$6x + 9y - 3z + (x - 3y + 3z) = 51 + (-4)$$

$$7x + 6y = 47$$

Subtract $7x + 5y = 45$ from $7x + 6y = 47$ to eliminate x.

$$7x + 6y - (7x + 5y) = 47 - 45$$

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$$7x - 7x + 6y - 5y = 47 - 45$$

$$y = 2$$

Find x by plugging 2 in for y into the equation $7x + 5y = 45$.

$$7x + 5(2) = 45$$

$$7x + 10 = 45$$

$$7x + 10 - 10 = 45 - 10$$

$$7x = 35$$

$$\frac{7x}{7} = \frac{35}{7}$$

$$x = 5$$

Find z by plugging 5 in for x and 2 in for y into the equation $2x + 3y - z = 17$.

$$2(5) + 3(2) - z = 17$$

$$10 + 6 - z = 17$$

$$16 - z = 17$$

$$16 - 16 - z = 17 - 16$$

$$-z = 1$$

$$z = -1$$

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6. E. Remember that the standard form of a quadratic expression is $ax^2 + bx + c$. For the equation $6x^2 - 11x + 4$: $a = 6$, $b = -11$, and $c = 4$. Multiply $a \cdot c$ and find factors of the result that combine to b.

$$6 \cdot 4 = 24$$

We'll make a table with all of the factors, and their sum.

Factors of 24	Sum
-1, -24	-25
-2, -12	-14
-3, -8	-11
-4, -6	-10

$-3 + -8 = -11$, so they're the factors we're looking for. Now we'll divide each factor by a and reduce if possible.

$$\frac{-3}{6} = \frac{-1}{2}$$

One factor of the quadratic is $(2x - 1)$ because the denominator of the reduced fraction becomes the coefficient to x, and then add or subtract the numerator depending on the sign (in this case we'll subtract since -1 was the numerator).

$$\frac{-8}{6} = \frac{-4}{3}$$

The other factor of the quadratic is $(3x - 4)$ because the denominator of the reduced fraction becomes the coefficient to x,

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and then add or subtract the numerator depending on the sign (in this case we'll subtract since -4 was the numerator).

$$(2x-1)(3x-4)$$

7. C. Switch x and y in the original equation.

$$y=\sqrt{x-2}+3$$

$$x=\sqrt{y-2}+3$$

Solve for y.

$$x-3=\sqrt{y-2}+3-3$$

$$x-3=\sqrt{y-2}$$

$$(x-3)^2=\sqrt{y-2}^2$$

$$x^2-3x-3x+9=y-2$$

$$x^2-6x+9=y-2$$

$$y-2+2=x^2-6x+9+2$$

$$y=x^2-6x+11$$

8. A. Combine the logarithms using the quotient rule.

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$$\log_4 \frac{32}{2}$$

$$\log_4 16$$

Convert from the form $y = \log_b x$ to $b^y = x$.

$$4^y = 16$$

$$y = 2$$

9. Simplify the powers of i by remembering that $i^2 = -1$.

$$\frac{4 - 3i}{1i^2 + 2i^5}$$

$$\frac{4 - 3i}{1(-1) + 2(-1)(-1)i}$$

$$\frac{4 - 3i}{-1 + 2i}$$

Use the conjugate method to get the imaginary number out of the denominator.

$$\frac{4 - 3i}{-1 + 2i} \cdot \frac{-1 - 2i}{-1 - 2i}$$

$$\frac{(4 - 3i)(-1 - 2i)}{(-1 + 2i)(-1 - 2i)}$$

Use the FOIL method to multiply the binomials in the numerator and denominator.

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$$\frac{-4 - 8i + 3i + 6i^2}{1 + 2i - 2i - 4i^2}$$

$$\frac{-4 - 5i + 6i^2}{1 - 4i^2}$$

Plug -1 in for i^2.

$$\frac{-4 - 5i + 6(-1)}{1 - 4(-1)}$$

$$\frac{-4 - 6 - 5i}{1 + 4}$$

$$\frac{-10 - 5i}{5}$$

$$-2 - i$$

10. Use the second equation and solve for y.

$$y - x = -1$$

$$y - x + x = -1 + x$$

$$y = x - 1$$

Plug $x - 1$ in for y into the first equation and solve for x.

$$(y - 2)^2 + x^2 = 9$$

$$(x - 1 - 2)^2 + x^2 = 9$$

$$(x-3)^2+x^2=9$$

$$x^2-6x+9+x^2=9$$

$$2x^2-6x+9=9$$

$$2x^2-6x+9-9=9-9$$

$$2x^2-6x=0$$

$$\frac{2x^2}{2}-\frac{6x}{2}=\frac{0}{2}$$

$$x^2-3x=0$$

$$x(x-3)=0$$

$x=0$ and $x=3$

Plug 0 in for x into the equation where y has already been isolated.

$$y=0-1$$

$$y=-1$$

Plug 3 in for x into the equation where y has already been isolated.

$$y=3-1$$

$$y=2$$

The solutions are:

$(0,-1)$ and $(3,2)$

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11. Draw the x- and y-axes and make sure to label tick marks and axes. The graph of $f(x) = x^2 - 1$ will be a parabola that opens up. The y-intercept can be found by substituting $x = 0$ in the equation and solving for y.

$$y = (0)^2 - 1 = -1$$

So put a point on the y-axis at -1. To find the x-intercept(s), set $y = 0$ and solve for x.

$$0 = x^2 - 1$$

$$1 = x^2$$

$$\pm\sqrt{1} = \sqrt{x^2}$$

$$\pm 1 = x$$

Plot points on x-axis at -1 and 1. Then we can sketch the parabola.

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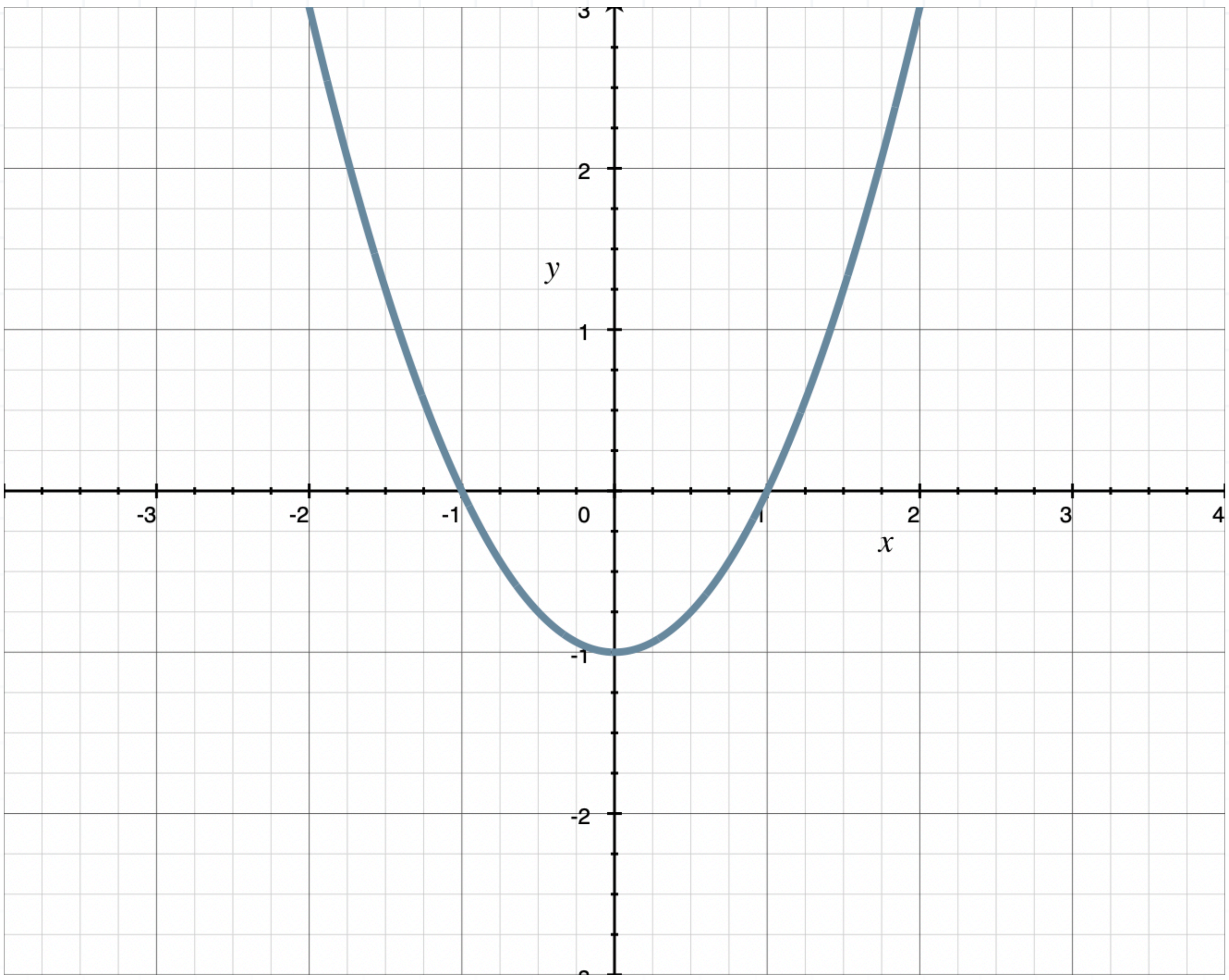

12. Plug $2x-5$ in for x into the $f(x)$ equation.

$$f(g(x))=3(2x-5)^2-4(2x-5)+12$$

Simplify.

$$f(g(x))=3(4x^2-20x+25)-8x+20+12$$

$$f(g(x))=12x^2-60x+75-8x+32$$

$$f(g(x))=12x^2-68x+107$$

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