Algebra 2 Worksheet Solutions

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Exponents and radicals

worksheet

1. Circle each expression that has the same value as $(-3/5)^2$.

$$(-1)\left(\frac{3}{5}\right)^2 \qquad \frac{-9}{25} \qquad \frac{3^2}{(-5)^2}$$

$$\frac{(-3)^2}{5^2} \qquad \frac{-3^2}{5^2} \qquad \frac{9}{25}$$

2. Choose the simplified expression.

$$\frac{x^{\frac{1}{5}}y^{-3}z^0}{x^{\frac{3}{5}}y^2z^{-2}}$$

$$\frac{z^2}{x^{\frac{2}{5}}y^5} \qquad \frac{z^2}{x^2y^5} \qquad \frac{1+z^2}{x^{\frac{2}{5}}y^5} \qquad \frac{z^2}{x^{\frac{2}{5}}y^{-1}}$$

3. Match each radical with a rational exponent.

$x^{\frac{2}{3}}$	$\sqrt[3]{x}$
$x^{\frac{3}{2}}$	$\sqrt{x^3}$
$x^{\frac{1}{2}}$	$\sqrt[3]{x^2}$
$x^{\frac{1}{3}}$	$\sqrt{x}$

4. Circle the simplified expression.

$$\sqrt{\frac{1}{16}}+\sqrt{\frac{2}{3}}+\sqrt{\frac{1}{6}}$$

$\frac{1}{4}+\sqrt{3}$ $\qquad$ $\frac{3\sqrt{6}}{4}$ $\qquad$ $\frac{1+2\sqrt{3}}{4}$ $\qquad$ $\frac{1+2\sqrt{6}}{4}$

5. Circle the first step at which a mistake is made in simplifying the expression.

$$\frac{1+\sqrt{3}}{1-\sqrt{3}}$$

Step 1: $\frac{(1+\sqrt{3})}{(1-\sqrt{3})}\cdot\frac{(1+\sqrt{3})}{(1+\sqrt{3})}$

Step 2: $\frac{(1+\sqrt{3})^2}{1-\sqrt{3}+\sqrt{3}-3}$

Step 3: $\frac{1+3}{1-3}$

Step 4: -2

Exponents and radicals

KEY POINTS	NOTES
Powers with negative bases	Case 1: $-b^a = -1 \cdot b^a$; Case 2: $(-b)^a$, multiply $-b$ times itself a times. Ex: $(-2)^4 = (-2)(-2)(-2) = -8$
Powers of fractions	Raise both the numerator and denominator the the power. Ex: $\left(\frac{a}{b}\right)^c = \frac{a^c}{b^c}$
Zero exponent	Any nonzero real number raised to the power 0 is equal to 1. Ex: $\frac{x^n}{x^n} = x^{n-n} = x^0 = 1$
Negative exponents	The rule of thumb is to write any negative exponents as positive exponents following the rules $a^{-b} = \frac{1}{a^b}$ and $\frac{1}{a^{-b}} = a^b$. Ex: $4^{-2} = \frac{1}{4^2} = \frac{1}{16}$
Fractional exponents	When you have a fractional exponent, the numerator (of the exponent) is the power and the denominator is the root. Ex: $x^{\frac{a}{b}} = \sqrt[b]{x^a}$
Rationalizing the denominator	Taking all of the radicals out of the denominator of a fraction and moving them to the numerator. Ex: $\frac{1}{\sqrt{2}} \cdot \frac{\sqrt{2}}{\sqrt{2}} = \frac{\sqrt{2}}{2}$

Exponents and radicals

KEY POINTS

NOTES

Rules about radicals

$$\sqrt{\frac{a}{b}}=\frac{\sqrt{a}}{\sqrt{b}},\ \sqrt{ab}=\sqrt{a}\sqrt{b},\ a\cdot\sqrt{b}=a\sqrt{b},$$

$$\sqrt{a}\cdot\sqrt{a}=a$$

Ratios and proportions

worksheet

1. There are 12 cats for every 8 dogs living in a city. If there are a total of $3{,}240$ cats and dogs in the city, how many dogs are there?

$1{,}080$ $\qquad$ $1{,}296$ $\qquad$ $1{,}944$ $\qquad$ $2{,}160$

2. Solve the proportion for the unknown value. $[x = 4]$

$$\frac{3{,}136}{56} = \frac{224}{x}$$

3. Complete the table.

Fraction	Decimal	Percent
5/8	0.625	62.5%
3/4	0.75	75%
1/100	0.01	1%

4. A store purchased an item from the manufacturer for $\$42$ and then sold it to a customer for $\$49.98$. What was the percent markup that the store applied to the item?

$0.798\,\%$ $\qquad$ $1.9\,\%$ $\qquad$ $7.98\,\%$ $\qquad$ $19\,\%$

5. Find the amount of interest earned in one year if the annual interest rate is $0.3\,\%$ and the principal balance is $\$2{,}000$. $[\$6]$

6. Match each fraction on the left with its reciprocal on the right.

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

7. Circle any complex fractions.

$$\frac{2}{3} \qquad \frac{\frac{2}{3}}{4} \qquad -\frac{5}{\frac{4}{x}} \qquad \frac{\frac{x+2}{5}}{\frac{8}{x-1}}$$

8. True or false? Dividing a number by $4/5$ or multiplying the number by $5/4$ will give the same result. [True]

9. Solve the equation for x. [$x = 22$]

$$\frac{\frac{x+2}{3}}{7} = \frac{2}{\frac{7}{4}}$$

10. Circle any expressions that are equivalent to the complex fraction.

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

$\frac{2}{x-3} \cdot \frac{4}{x+5}$ $\qquad$ $\frac{2x+10}{4x-12}$ $\qquad$ $\frac{8}{(x-3)(x+5)}$ $\qquad$ $\frac{x+5}{2(x-3)}$

11. Circle the simplifies version of $\sqrt{-64}$.

-8 $\qquad$ $\pm 8i$ $\qquad$ $8i$ $\qquad$ $8i^2$

12. Match each power of i with its simplified form.

i^{102}	i
i^{73}	$-i$
i^{211}	-1
i^{1000}	1

13. Simplify the expression $5i^3 - 2i^2 + i^4 - i + 8 - \sqrt{-4}$. $[11 - 8i]$

14. True or false? The conjugate of $3 + 2i$ is $-3 - 2i$.

[False. The conjugate of $3 + 2i$ is $3 - 2i$.]

15. Circle the simplified expression.

$$\frac{i+1}{i-1}$$

1 $\quad$ 0 $\quad$ -1 $\quad$ $-i$

Ratios and proportions

KEY POINTS	NOTES
Ratio	A comparison of two numbers (or other mathematical expressions), and it is often written as a fraction. Ex: The ratio of cats to dogs can be written as $\frac{\text{number of cats}}{\text{number of dogs}}$.
Proportion	A proportion is an equality between two ratios. Use cross multiplication to solve proportions. Ex: A proportion is written as $\frac{a}{b}=\frac{c}{d}$ and we solve by using cross multiplication: $a \cdot d = c \cdot b$.
Percent	An amount or part out of 100. Ex: $4\,\% = \frac{4}{100}$
Convert percent to decimal	Divide a percent by 100 to get a decimal number. Ex: $49\,\% = \frac{49}{100} = 0.49$
Convert decimal to percent	Multiply a decimal number by 100 to get a percent. Ex: $0.05 \cdot 100 = 5\,\%$
Convert fraction to percent	Change the fraction to a decimal, then change the decimal to a percent. Ex: $\frac{1}{4} = 0.25$ and $0.25 \cdot 100 = 25\,\%$

Ratios and proportions

KEY POINTS	NOTES
Percent of a number	To find a percent of a number, multiply the number by the decimal form or the fractional form of the percent. Ex: $10\,\%$ of 50 is $10\% \cdot 50 = 0.1 \cdot 50 = 5$
Percent markup	$\text{Markup Amount} = \text{Original Price}\left(\frac{\text{Percent Markup}}{100}\right)$
Percent markdown	$\text{Discount Amount} = \text{Original Price}\left(\frac{\text{Percent Markdown}}{100}\right)$ $\frac{\text{Discount Amount}}{\text{Original Price}} = \frac{\text{Percent Markdown}}{100}$
Commission	The amount a salesperson makes on the sale of an item. Ex: $\text{Commission} = \text{Selling Price} \cdot \text{Percent Commission}$
Simple interest	The amount you earn on an investment each year. Ex: $I = Prt$

Ratios and proportions

KEY POINTS	NOTES
Complex fractions	A fraction that includes fractions either in the numerator, denominator or both. Ex: $\frac{\left(\frac{a}{b}\right)}{\left(\frac{c}{d}\right)}$.
Reciprocal	The reciprocal of a fraction is just that fraction "flipped upside down." Ex: The reciprocal of $\frac{a}{b}$ is $\frac{b}{a}$.
Solving complex fractions	When a complex fraction in a proportion has a variable, you can solve for that variable in one of two ways: cross multiplication or multiply by reciprocals. Remember that cross multiplication of $\frac{a}{b}=\frac{c}{d}$ results in $ad=bc$.
Imaginary number, i	$i=\sqrt{-1}$
Square of i	$i^2=-1$
Complex number	The sum of a real number and an imaginary number is written in the form $a+bi$ where a and b are real numbers. Ex: $8-6i$ where $a=8$ and $b=-6$.

Ratios and proportions

KEY POINTS

Complex conjugate

NOTES

$a + bi$ and $a - bi$ are conjugates

Factoring

worksheet

1. Circle the binomial factors of the quadratic $6x^2 + 13x + 6$.

$2x + 3$ $\qquad$ $2x + 2$ $\qquad$ $3x + 3$ $\qquad$ $3x + 2$

2. What should A be to allow us to factor the polynomial $5x^3 + 20x^2 + Ax + 8$ by grouping?

4 $\qquad$ -4 $\qquad$ 2 $\qquad$ -2

3. True or false? The binomial $64x^6 - 1$ could be factored both as a difference of cubes or as a difference of squares. [True]

4. Match the binomial in standard form with its factored form.

$x^3 + 1$	$(x - 1)(x^2 + x + 1)$
$x^3 - 1$	$(2x + 3)(4x^2 - 6x + 9)$
$8x^3 - 27$	$(x + 1)(x^2 - x + 1)$
$8x^3 + 27$	$(2x - 3)(4x^2 + 6x + 9)$

5. Which quadratic would have roots $x = -1$ and $x = 6$?

$2x^2 - 10x - 12$ $\qquad$ $x^2 - 5x + 6$

$2x^2 - 10x + 12$ $\qquad$ $2x^2 - 5x - 6$

Factoring

KEY POINTS | **NOTES**

Factoring quadratics when $a \neq -1,1$

To factor $ax^2 + bx + c$, find factors of the product ac whose sum is b. Rewrite the quadratic with 4 terms and factor by grouping.

Factor by grouping

When factoring a polynomial with 4 terms, group two terms and factor out a common factor, then group the other two terms and factor out a common factor. If the result of each groups is the same, factor out that common factor. Ex: $4x^2 + 2x + 6x + 3$, Group the first two terms and the last two terms, then factor out common factors.
$(4x^2 + 2x) + (6x + 3) = 2x(2x + 1) + 3(2x + 1)$,
Factor out the common factor of $(2x + 1)$,
$2x(2x + 1) + 3(2x + 1) = (2x + 1)(2x + 3)$

Difference of two cubes

$a^3 - b^3 = (a - b)(a^2 + ab + b^2)$
Ex: $x^3 - 8 = (x - 2)(x^2 + 2x + 4)$

Sum of two cubes

$a^3 + b^3 = (a + b)(a^2 - ab + b^2)$
Ex: $x^3 + 27 = (x + 3)(x^2 - 3x + 9)$

Rational functions

worksheet

1. Circle the remainder after dividing $3x^3 - 2x^2 - 5x + 7$ by $3x + 4$?

$3x + 4$ $\quad\quad$ $\dfrac{11}{3x + 4}$ $\quad\quad$ $x^2 - 2x + 1$ $\quad\quad$ $\dfrac{3}{3x + 4}$

2. What is the greatest common factor by which all terms can be reduced? [$2xy^2$]

$$\frac{2xy^3 - 4x^2y^5}{8xy^2}$$

3. What is the least common denominator for the sum? [$18x^4y^3$]

$$\frac{8}{9x^4y} + \frac{8}{6x^2y^3}$$

4. Circle the simplified expression.

$$\frac{4x}{x^2 - 16} \cdot \frac{x^2 - 5x + 4}{2x^2 + 2x - 4}$$

$\dfrac{1}{x + 4}$ $\quad\quad$ $\dfrac{2x}{(x + 4)(x + 2)}$ $\quad\quad$ $\dfrac{1}{2x + 4}$ $\quad\quad$ $\dfrac{4x}{(x + 4)(x + 2)}$

5. Circle all of the values that should be excluded from the domain.

$$\frac{x+4}{x-3} \div \frac{x^2-1}{x}$$

$x \neq 3$	$x \neq -4$	$x \neq 1$	$x \neq -1$
$x \neq 2$	$x \neq -3$	$x \neq 4$	$x \neq 0$

Rational functions

KEY POINTS	NOTES
Long division of polynomials	Follow the same steps for long division of real numbers. Make sure to align like terms.
Simplifying rational expressions	Factor polynomials in the numerator and denominator completely and cancel factors that are shared by all terms of the numerator and denominator.
Adding or subtracting rational expressions	Common denominators are needed to add or subtract rational expressions, just like adding or subtracting fractions.
Multiplying rational expressions	Cancel factors from the denominator of a product of rational expressions first, when possible, then multiply remaining polynomials. You may have to factor and cancel factors again. Don't forget to explicitly state the "hidden" values of the variable that are excluded from the domain.
Dividing rational expressions	Factor and simplify by canceling common factors in the numerator and denominator when possible. Remember to change fraction division to multiplication by the reciprocal of the second fraction.

Advanced equations

worksheet

1. Label each scenario as direct variation, inverse variation, or neither.

   The number of songs downloaded on your phone, and the amount of memory you have left. inverse

   The number of shoes you buy, and the cost of your bill. direct

   The number of pets you have, and your grade in English. neither

2. Solve the equation for x.

   $$0.01x - 0.5x + 0.078 = -1$$

   $x = -1.88$ $\quad$ $x = 1.88$ $\quad$ $x = 2.2$ $\quad$ $x = 2.695$

3. Circle the solution(s) of the equation.

   $$\sqrt{x-4} = \frac{1}{5}x$$

   $x = 4$ $\quad$ $x = 5$ $\quad$ $x = 20$ $\quad$ no solution

4. True or false? If $2a + 3b - 5c = 12$, then the values of a, b, and c are

   $$a = \frac{-3b + 5c + 12}{2} \qquad b = \frac{-2a + 5c + 12}{3} \qquad c = \frac{2a + 3b - 12}{5}$$ [True]

5. Gwen can bike 30 miles in 2 hours. How far can she travel at this same pace if she bikes for 5.5 hours?

15 miles 52.5 miles 82.5 miles 165 miles

Advanced equations

KEY POINTS	NOTES
Direct variation	Relationships in the form $kx = y$, where k is a constant and x and y are variables. As one variable increases, the other variable will also increases.
Inverse variation	Relationships in the form $y = \frac{k}{x}$, where k is a constant and x and y are variables. As one variable increases the other variable decreases.
Solving decimal equations	Multiply by an appropriate power of 10 to clear decimals and work with integers. Ex: $0.2x = 10$ Multiply by 10 on both sides to clear the decimal term. $0.2x(10) = 10(10)$, Simplify. $2x = 100$, Divide by 2 on both sides. $x = 50$.
Solving fraction equations	Clear fractions by multiplying both sides of the equation by the LCD of all fractions in the equation, then solve using traditional methods of solving equations.
Extraneous solutions	Values that are not actually solutions of the original equation. When solving rational or radical equations, evaluate the original equations with the potential solutions you have found. If the statement is true, then the

Advanced equations

KEY POINTS

NOTES

value is indeed a solution; otherwise, it is extraneous.

Solving multivariable equations

Use inverse operations to isolate the variable you're solving for.

Systems of equations

worksheet

1. Solve the system of equations for x_1 using any method.

$$2x_1 - x_2 = 12 \qquad \frac{1}{5}x_1 + \frac{1}{2}x_2 = 0$$

$x_1 = -2$ $\qquad$ $x_1 = 0$ $\qquad$ $x_1 = 5$ $\qquad$ $x_1 = 10$

2. True or false? There can be either 0, 1, or 2 solutions between the graph of a circle and a quadratic.

[False. While it's possible to have 0, 1, or 2 solutions, it's also possible that there are more than two solutions.]

3. Two even consecutive integers have a sum of 66. Circle the equation that must be true, with n representing the lesser of the two numbers.

$2n + 2 = 66$ $\qquad$ $2n + 1 = 66$ $\qquad$ $n + 2 = 66$ $\qquad$ $n^2 + 2n = 66$

4. Four years ago, Bethany was 15 years older than Mackenzie, and Mackenzie was 3 years younger than twice Jared's age. Now, Jared is 10 years younger than Mackenzie. How old is Bethany now?

36 $\qquad$ 38 $\qquad$ 42 $\qquad$ 40

5. Solve the system of equations using any method. $[(-5, 3, 13)]$

$$x + y + z = 11 \qquad -2x + 2y - z = 3 \qquad 2x - y + 2z = 13$$

Systems of equations

KEY POINTS	NOTES
Variables with subscripts	Variables with subscripts should be treated uniquely. Ex: t_1, t_2, t_3 could represent three time measurements read as, "time 1," "time 2," and "time 3."
Uniform motion	Distance $=$ Rate $\cdot$ Time
Solution to systems of equations	The solution to a system of equations in two variables is an ordered pair (x, y), or multiple ordered pairs, in which the values satisfy both equations.
Consecutive integers	Integers that are in ascending order and have no integer between them. Ex: 4 and 5.
Consecutive even integers	Even integers that are in ascending order and have no even integer between them. Ex: 4 and 6.
Consecutive odd integers	Odd integers that are in ascending order that have no odd integer between them. Ex: 3 and 5.
Systems of three equations	Three equations with three variables where the solution consists of one value for each variable that satisfies every equation. The

Systems of equations

KEY POINTS

NOTES

solution can be written as an ordered triplet (x, y, z).

Graphing

worksheet

1. Circle each line that's perpendicular to $6x - 2y = 4$.

$y = 6x - 2$ $\quad$ $y = -\frac{1}{3}x + 3$ $\quad$ $-3y = x - 1$ $\quad$ $y = 3x + \frac{1}{2}$

2. What will be the value of k after converting $y = 2x^2 - 4x + 1$ to vertex form, $y = a(x - h)^2 + k$? [-1]

3. What's the distance from the center in Circle A, $(x - 3)^2 + (y + 1)^2 = 4$, to Circle B, $(x + 5)^2 + (y + 3)^2 = 9$?

$\sqrt{5}$ $\quad$ 5 $\quad$ $2\sqrt{15}$ $\quad$ $2\sqrt{17}$

4. True or false? If a circle has one end of its diameter at $(-5,3)$, and the other end at $(1,3)$, then the equation of the circle would be $(x + 2)^2 + (y - 3)^2 = 9$.

[True, the length of the diameter would be 6, so the circle has a radius of 3 and the midpoint of the diameter would be $(-2,3)$.]

5. Use the function $f(x)$ to calculate each value.

$$f(x) = \begin{cases} -x + 1 & x < -4 \\ 5 & -4 < x \le 3 \\ -2x + 11 & x > 3 \end{cases}$$

$f(-10) =$ <u>11</u>

$f(3) =$ <u>5</u>

$f(4) =$ <u>3</u>

Graphing

KEY POINTS	NOTES
Parallel lines	Lines whose slopes are equal but their y-intercepts are different. The graphs of parallel lines never cross or touch. Ex: $\begin{cases} y = 3x + 5 \\ y = 3x - 4 \end{cases}$.
Perpendicular lines	Lines whose slopes are opposite reciprocal. The graphs of perpendicular lines intersect at a right angle. Ex: $\begin{cases} y = 3x + 5 \\ y = -\frac{1}{3}x - 4 \end{cases}$.
Standard form of a quadratic	$y = ax^2 + bx + c$
Axis of symmetry of a quadratic	$x = -\dfrac{b}{2a}$
Vertex form of a quadratic	$y = a(x - h)^2 + k$, (h, k)
Standard form of a circle	$(x - h)^2 + (y - k)^2 = r^2$, where r is the radius and (h, k) is the center. Ex: $(x - 1)^2 + (y - 2)^2 = 16$ has a center at $(1,2)$ and a radius of 4.
Distance formula	The distance between two points (x_1, y_1) and (x_2, y_2) is $d = \sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2}$.

Graphing

KEY POINTS	NOTES
Piecewise function	A function that is made up of different "pieces," each of which has its own "sub-function" and its own "sub-domain." Ex: $f(x) = \begin{cases} -3 & x \leq -2 \\ \frac{5}{4}x - 2 & -2 < x < 2 \\ 2 & x \geq 2 \end{cases}$
Story problems and horizontal lines	They represent a value that doesn't change. Ex: As time goes on, or increases, the height of an object stays constant.
Story problems and positive slope	Positive slope shows a relationship between two variables is increasing. Ex: As time increases, the height of an object increases.
Story problems and negative slope	Negative slope shows that as one variable increases, the other variable decreases. Ex: As time increases, the height of an object decreases.

Manipulating functions

worksheet

1. For $f(x)=x^2+4$ and $g(x)=\sqrt{x}-1$, match each function to its value.

$(f+g)(1)$	0
$(g-f)(1)$	4
$(g\cdot f)(1)$	5
$(f(g(1)))$	-5

2. Circle the statement that's always true.

$f(g(x))=g(f(x))$ $\qquad$ $(f\cdot g)(x)=(g\cdot f)(x)$ $\qquad$ $(f-g)(x)=(g-f)(x)$

3. Fill every cell in the table with "Yes" or "No."

	Passes the VLT	Passes the HLT	Is One-to-One
$y^2=x$	No	Yes	No
$y=x^3$	Yes	Yes	Yes
$y=x^2$	Yes	No	No

4. Is the inverse of $f(x)=(x-2)^3+4$ always $f^{-1}(x)=\sqrt[3]{x+2}-4$? [No.]

5. The vertex of $f(x)$ is at $(3,2)$ and $f(1)=6$. Circle all outputs of $f^{-1}(11)$.

-3 $\qquad$ 0 $\qquad$ 3 $\qquad$ 6

Manipulating functions

KEY POINTS	NOTES
Sum function	$(f+g)(x)=f(x)+g(x)$
Difference function	$(f-g)(x)=f(x)-g(x)$
Product function	$(f\cdot g)(x)=f(x)\cdot g(x)$
Quotient function	$(f\div g)(x)=\dfrac{f(x)}{g(x)}$
Composite function	$(f\circ g)(x)=f(g(x))$ It means to treat the function $g(x)$ as the variable in $f(x)$.
Domain of a composite function	The domain will exclude all values of x where $g(x)$ is undefined, and all values of x where $g(x)$ is defined but $f(g(x))$ is undefined.
One-to-one function	A function is one-to-one, if it has exactly one x-value in its domain for each y-value in its range.
Horizontal line test	A graph passes the Horizontal Line Test if no two points of the graph have the same y-coordinate (if no horizontal line intersects the graph at more than one point).
Inverse function	A function that reverses or “undoes” another function. The inverse of a function $f(x)$ is written as $f^{-1}(x)$.

Exponential and logarithmic functions

worksheet

1. If $\log_b a = x$, circle the equation that must be true.

$b^a = x$ $\qquad$ $x^a = b$ $\qquad$ $b^x = a$ $\qquad$ $a^x = b$

2. Match each log expression on the left to its value on the right.

$\log 1{,}000$	0
$\ln e^4$	5
$\log_5 1$	1
$\log_2 32$	3
$\ln e$	4

3. Circle the inverse $f^{-1}(x)$ of the function $f(x) = \log_b(x + 4)$.

$f^{-1}(x) = b^x - 4$ $\qquad$ $f^{-1}(x) = x^b - 4$ $\qquad$ $f^{-1}(x) = b^{x-4}$ $\qquad$ $f^{-1}(x) = b^x + 4$

4. If $\log_8 2 + \log_8(4x) = 1$, circle all statements that must be true.

$\log_8(2 + 4x) = 1$ $\qquad$ $x = 1$ $\qquad$ $\log_8(8x) = 1$ $\qquad$ $\log_8(4x) = \dfrac{2}{3}$

5. If $\log_a b = 5$ and $\log a = 2$, then circle the value of $\log b$.

0.2 $\qquad$ 3 $\qquad$ 7 $\qquad$ 10

Exponential and logarithmic functions

KEY POINTS	NOTES
Exponents	An exponent tells us how many times to multiply the base by itself. Ex: $2^3 = 2 \cdot 2 \cdot 2 = 8$
Logarithms	Tell us how many times we multiply one number by itself in order to get a different number. Logarithms (or "logs," for short) tell us what the value of the exponent needs to be in order to make the equation true. Ex: $\log_2(8) = 3$ means $2^3 = 8$.
Base of a logarithm	In $\log_b(a) = x$, b is the base.
Argument of a logarithm	In $\log_b(a) = x$, a is the argument.
Common logarithm	A logarithm that has a base of 10.
Natural logarithm	A logarithm with base of e. Ex: $\log_e(x) = \ln(x)$
Product rule	$\log_a(xy) = \log_a x + \log_a y$ and $\ln(xy) = \ln x + \ln y$
Quotient rule	$\log_a\left(\frac{x}{y}\right) = \log_a x - \log_a y$ and $\ln\left(\frac{x}{y}\right) = \ln x - \ln y$
Power rule	$\log_a(x^n) = n \log_a x$ and $\ln(x^n) = n \ln x$

Exponential and logarithmic functions

KEY POINTS	NOTES
Change of base	$\log_a b = \dfrac{\log_c b}{\log_c a}$ Ex: $\log_5 4 = \dfrac{\log_{10} 4}{\log_{10} 5} \approx 0.8614$

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