

Northern Michigan University (Marquette Co, MI)

MA111-04-26W: College Algebra (Andrew A. Poe)
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Name: _____

Sunday 26 April 2026 7:00 P.M. EDT

Time: 110 minutes

1. Simplify the following expression:

$$\sqrt[3]{x^4 y^5 z^6} = \sqrt[3]{x^3} \sqrt[3]{y^3} \sqrt[3]{z^6} \sqrt[3]{x y^2} = \boxed{xyz^2 \sqrt[3]{xy^2}}$$

2. Simplify the following expression:

$$\frac{|x^2 - y^2|}{|x + y|} = \frac{|x-y| |x+y|}{|x+y|} = \boxed{|x-y|}$$

3. Simplify the following expression:

$$\sqrt{(x^2 y^3)^{1/5}} = \sqrt{x^{2/5} y^{3/5}} = (x^{2/5} y^{3/5})^{1/2} = x^{1/5} y^{3/10}$$

4. Simplify the following expression:

$$\frac{2x^{2/3} y^{-1/3}}{10x^{-4/3} y^{8/3}} = \frac{2x^{2/3+4/3}}{10y^{8/3+1/3}} = \boxed{\frac{x^2}{5y^3}}$$

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5. Compute the product:

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

$$\begin{array}{r} 2x+3 \\ \underline{x+4} \\ 8x+12 \\ \underline{2x^2+3x} \\ 2x^2+11x+12 \end{array}$$

$$\begin{array}{r} 2x^2+11x+12 \\ \underline{x-2} \\ -4x^2-22x-24 \\ \underline{2x^3+11x^2+12x} \end{array}$$

$$\boxed{2x^3 + 7x^2 - 10x - 24}$$

6. Simplify the following rational expression:

$$\frac{4x^2 - 22x - 12}{20x^2 - 5} = \frac{2}{5} \frac{(2x^2 - 11x - 6)}{(4x^2 - 1)} = \frac{2}{5} \frac{2(x-6)(x+\frac{1}{2})}{(2x+1)(2x-1)} = \frac{2}{5} \frac{(x-6)(2x+1)}{(2x+1)(2x-1)}$$

$$= \boxed{\frac{2(x-6)}{5(2x-1)}}$$

7. Simplify the following expression by rationalizing the denominator:

$$\frac{1}{\sqrt{5} - \sqrt{2}} \cdot \frac{\sqrt{5} + \sqrt{2}}{\sqrt{5} + \sqrt{2}} = \frac{\sqrt{5} + \sqrt{2}}{5 - 2} = \frac{\sqrt{5} + \sqrt{2}}{3}$$

8. Solve the following equation for x:

$$\sqrt{5-x} = x+1$$

$$(\sqrt{5-x})^2 = (x+1)^2$$

$$5-x = x^2 + 2x + 1$$

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

$$x \rightarrow -4 \quad + \rightarrow 3$$

$$-4 \quad +1$$

$$x = -4, 1$$

$$\boxed{x=1}$$

Test 1: $\sqrt{5-1} = |1+1|$

$$\sqrt{4} = 2$$

2 = 2 WORKS

Test -4: $\sqrt{5-(-4)} = |-4+1|$

$$\sqrt{9} = -3$$

$$3 = -3$$

Does not work

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9. Find the equation of the line (in $mx+b$ form) parallel to the line $y = 3x - 4$ and passing through the point $(1,5)$.

$$m=3$$

$$y = m x + b$$

$$5 = 3 \cdot 1 + b$$

$$5 = 3 + b$$

$$b = 2$$

$$y = 3x + 2$$

10. Find the center and radius of the following circle:

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

$$x^2 + 2x + 1 - 1 + y^2 - 6y + 9 - 9 = 11$$

$$(x+1)^2 + (y-3)^2 = 21$$

Center: $(-1, 3)$
radius: $\sqrt{21}$

11. $f(x) = x^2 - 3$; $g(x) = 3x + 5$. Find $f \circ g(x)$.

$$f(g(x)) = f(3x+5) = (3x+5)^2 - 3 = 9x^2 + 30x + 25 - 3 = \boxed{9x^2 + 30x + 22}$$

12. $f(x) = 2x - 11$. Compute the inverse of f .

$$y = 2x - 11$$

$$x = \frac{y + 11}{2}$$

$$2y = x + 11$$

$$y = \frac{x + 11}{2}$$

$$\boxed{f^{-1}(x) = \frac{x + 11}{2}}$$

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13. I have 20 grams of a radioactive substance. In ten days, 5 grams of it will remain. What is the half-life of this substance?

$$f(x) = a(b^x)$$

$$f(0) = a \cdot (b^0)$$

$$20 = a$$

$$f(10) = a(b^{10})$$

$$5 = 20(b^{10})$$

$$\frac{1}{4} = b^{10}$$

$$b = \frac{1}{4}^{1/10}$$

$$f(x) = 20 \cdot \left(\frac{1}{4}\right)^{x/10}$$

$$10 = 20 \left(\frac{1}{4}\right)^{x/10}$$

$$\left(\frac{1}{4}\right)^{x/10} = \frac{1}{2}$$

$$\left[\left(\frac{1}{2}\right)^2\right]^{x/10} = \frac{1}{2}$$

$$\frac{1}{2}^{x/5} = \frac{1}{2}^1$$

$$x/5 = 1$$

$$x = 5 \text{ days}$$

14. Express the following as a function in the form $f(x) = a(b^x)$.

$$f(x) = \frac{11^x}{12^{x+2}}$$

$$= \frac{11^x}{12^x \cdot 12^2}$$

$$= \frac{1}{144} \left(\frac{11}{12}\right)^x$$

15. Simplify this expression.

$$\log_7 35 + \log_7 14 - \log_7 10 = \log_7 \frac{35 \cdot 14}{10} = \log_7 \frac{7 \cdot 5 \cdot 2 \cdot 7}{2 \cdot 5}$$

$$= \log_7 7^2 = \boxed{2}$$

16. Solve the following equation for x:

$$\log_7(100 - x^2) = 2$$

$$7^{\log_7(100 - x^2)} = 7^2$$

$$100 - x^2 = 49$$

$$x^2 = 100 - 49$$

$$x^2 = 51$$

$$x = \sqrt{51}, -\sqrt{51}$$

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17. Solve the following inequality for x:

$$12x^2 > 7x + 12$$

$$12x^2 > 7x + 12$$

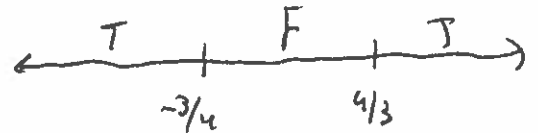
$$12x^2 - 7x - 12 > 0$$

$$x \rightarrow -144 \quad + \rightarrow -7$$

$$\frac{+16}{12} \quad \frac{9}{-12}$$

$$x > \frac{4}{3}, -\frac{3}{4}$$

$$(-\infty, -\frac{3}{4}) \cup (\frac{4}{3}, \infty)$$



Try 0

$$12 \cdot 0^2 > 7 \cdot 0 + 12$$

$$0 > 12$$

False

18. Solve the following inequality for x:

$$\frac{2x - 100}{x^2 - 7} \leq 0$$

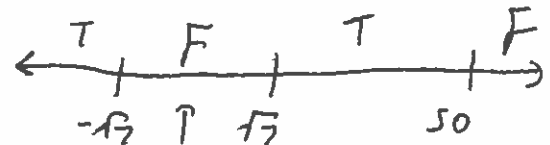
NUM! $2x - 100 = 0$
 $x = 50$

DEN! $x^2 - 7 = 0$
 $x^2 = 7$

$$x = \sqrt{7}, -\sqrt{7}$$

$$(-\infty, -\sqrt{7}) \cup (\sqrt{7}, 50]$$

square bracket



Try 0

$$\frac{2 \cdot 0 - 100}{0^2 - 7} \leq 0$$

$$\frac{-100}{-7} \leq 0$$

$$\frac{100}{7} \leq 0$$

FALSE

19. Using the rational root theorem, find all three solutions for x in the following equation:

$$14x^3 - x^2 - 11x + 4 = 0$$

$$\begin{array}{r} \downarrow \\ 14 \quad -1 \quad -11 \quad 4 \\ \quad 14 \quad 13 \quad 2 \\ \hline 14 \quad 13 \quad 2 \quad 6 \quad 10 \end{array}$$

$$\begin{array}{r} \downarrow \\ 14 \quad -1 \quad -11 \quad 4 \\ \quad -14 \quad 13 \quad -7 \\ \hline 14 \quad -15 \quad 4 \quad 0 \end{array}$$

-1 is one

works

$$14x^3 - 15x + 4 = 0$$

$$x \rightarrow 56 \quad + \rightarrow -15$$

$$\frac{+7}{14} \quad \frac{+8}{14}$$

$$\frac{1}{2} \quad \frac{4}{7}$$

$$x = -1, \frac{1}{2}, \frac{4}{7}$$

20. Use completing the square to find the horizontal, vertical and stretch transformations on the following parabola. Sketch the graph of the parabola.

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

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

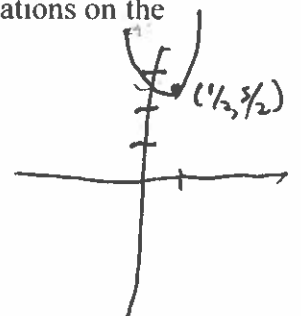
$$= 2(x^2 - x + \frac{1}{4} - \frac{1}{4}) + 3$$

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

$$y = 2(x - \frac{1}{2})^2 - \frac{1}{2} + 3$$

$$y = 2(x - \frac{1}{2})^2 + \frac{5}{2}$$

rt. shift $\frac{1}{2}$ up $\frac{5}{2}$



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EXTRA CREDIT PROBLEMS

21. Solve the following inequality for x :

$$|3x - 7| > 11$$

$$3x - 7 > 11$$

OR

$$3x - 7 < -11$$

$$3x > 18$$

OR

$$3x < -4$$

$$x > 6$$

$$x < -\frac{4}{3}$$

$$x \in (-\infty, -\frac{4}{3}) \cup (6, \infty)$$

22. What is the domain of the following function? What is the inverse? What is the domain of the inverse?

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

$$\text{DOM: } 3x + 7 \neq 0 \quad x \neq \frac{7}{3}$$

$$\text{INV: } y = \frac{4x + 2}{3x + 7}$$

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

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

$$\text{DOM: } 3x - 4 \neq 0 \quad x \neq \frac{4}{3}$$

$$3xy + 7x = 4y + 2$$

$$3xy - 4y = -7x + 2$$

$$y(3x - 4) = -7x + 2$$

23. Find the x - and y -intercepts and the horizontal and vertical asymptotes of the following graph. Sketch the graph.

$$f(x) = \frac{x + 11}{6x^2 - 29x - 5}$$

$$x\text{-int: } x + 11 = 0 \quad x = -11$$

$$y\text{-int: } \frac{0 + 11}{6(0)^2 - 29(0) - 5} = \frac{11}{-5} = -\frac{11}{5}$$

$$\text{horiz. asympt. } x\text{-axis } (y = 0)$$

$$\text{vert. asympt. } 6x^2 - 29x - 5 = 0$$

$$x \rightarrow -30 \quad + \rightarrow -29$$

$$\frac{-30}{6} \quad \frac{-1}{6}$$

$$x = 5$$

$$x = -\frac{1}{6}$$

