

Unit 6 Test Study Guide (Radical Functions)

Name: _____

Date: _____ Block: _____

Topic 1: Simplifying Radicals

Perfect Squares: 1, 4, 9, 16, 25, 36, 49, 64, 81, 100, 121, 144, 169, 196, ...

Perfect Cubes: 1, 8, 27, 64, 125, 216, 343, 512, 729, 1000, 1331, ...

Perfect Fourth: 1, 16, 81, 256, 625, 2401, 4096, 6561, 10000, ...

<p>1. $-2\sqrt{294m^{16}n^7}$</p> $-2\sqrt{49m^{16}n^6} \sqrt{6n}$ $-2 \cdot 7m^8n^3 \sqrt{6n}$ <div style="border: 1px solid black; padding: 2px; width: fit-content; margin: 0 auto;">$-14m^8n^3\sqrt{6n}$</div>	<p>2. $5\sqrt[3]{-80a^5}$</p> $5\sqrt[3]{8a^3} \sqrt[3]{10a^2}$ $5 \cdot -2a \sqrt[3]{10a^2}$ <div style="border: 1px solid black; padding: 2px; width: fit-content; margin: 0 auto;">$-10a\sqrt[3]{10a^2}$</div>	<p>3. $-3\sqrt[4]{256p^{13}q^5}$</p> $-3\sqrt[4]{256p^{12}q^4} \sqrt[4]{pq}$ $-3 \cdot 4p^3q \sqrt[4]{pq}$ <div style="border: 1px solid black; padding: 2px; width: fit-content; margin: 0 auto;">$-12p^3q\sqrt[4]{pq}$</div>
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Topic 2: Operations with Radicals

Simplify.

<p>4. $-\sqrt{6} - 3\sqrt{45} + 2\sqrt{96}$</p> $-\sqrt{6} - 3\sqrt{9}\sqrt{5} + 2\sqrt{16}\sqrt{6}$ $-\sqrt{6} - 9\sqrt{5} + 8\sqrt{6}$ <div style="border: 1px solid black; padding: 2px; width: fit-content; margin: 0 auto;">$-9\sqrt{5} + 7\sqrt{6}$</div>	<p>5. $\sqrt[3]{24} - 2\sqrt[3]{112} + 3\sqrt[3]{7}$</p> $\sqrt[3]{8}\sqrt[3]{3} - 2\sqrt[3]{16}\sqrt[3]{7} + 3\sqrt[3]{7}$ $2\sqrt[3]{8} - 4\sqrt[3]{7} + 3\sqrt[3]{7}$ <div style="border: 1px solid black; padding: 2px; width: fit-content; margin: 0 auto;">$2\sqrt[3]{8} - \sqrt[3]{7}$</div>	<p>6. $\sqrt[3]{-12x^4y} \cdot \sqrt[3]{4x^2y^2}$</p> $\sqrt[3]{-48x^6y^3}$ $\sqrt[3]{8x^6y^3} \sqrt[3]{6}$ <div style="border: 1px solid black; padding: 2px; width: fit-content; margin: 0 auto;">$-2x^2y\sqrt[3]{6}$</div>
<p>7. $\sqrt{18}(5-\sqrt{2}) - 11\sqrt{2}$</p> $5\sqrt{18} - \sqrt{36} - 11\sqrt{2}$ $5\sqrt{9}\sqrt{2} - 6 - 11\sqrt{2}$ $15\sqrt{2} - 6 - 11\sqrt{2}$ <div style="border: 1px solid black; padding: 2px; width: fit-content; margin: 0 auto;">$-6 + 4\sqrt{2}$</div>	<p>8. $(\sqrt{3} + \sqrt{6})(2\sqrt{3} - 5\sqrt{6})$</p> $2\sqrt{9} - 5\sqrt{18} + 2\sqrt{18} - 5\sqrt{36}$ $6 - 3\sqrt{18} - 30$ $-24 - 3\sqrt{9}\sqrt{2}$ <div style="border: 1px solid black; padding: 2px; width: fit-content; margin: 0 auto;">$-24 - 9\sqrt{2}$</div>	<p>9. $(\sqrt{5} - 2)^2$</p> $(\sqrt{5} - 2)(\sqrt{5} - 2)$ $\sqrt{25} - 2\sqrt{5} - 2\sqrt{5} + 4$ $5 - 4\sqrt{5} + 4$ <div style="border: 1px solid black; padding: 2px; width: fit-content; margin: 0 auto;">$9 - 4\sqrt{5}$</div>
<p>10. $\frac{\sqrt[3]{324}}{\sqrt{4}} \quad \sqrt[4]{81}$</p> <div style="border: 1px solid black; padding: 2px; width: fit-content; margin: 0 auto;">3</div>	<p>11. $\frac{\sqrt{112a^6b^{12}}}{\sqrt{7a^2b^3}}$</p> $\sqrt{16a^4b^9}$ $\sqrt{16a^4b^8} \sqrt{b}$ <div style="border: 1px solid black; padding: 2px; width: fit-content; margin: 0 auto;">$4a^2b^4\sqrt{b}$</div>	<p>12. $\frac{\sqrt[3]{7}}{\sqrt[3]{56}} \quad \frac{1}{\sqrt[3]{8}}$</p> <div style="border: 1px solid black; padding: 2px; width: fit-content; margin: 0 auto;">$\frac{1}{2}$</div>

$13. \frac{5\sqrt{6}}{\sqrt{15}} = \frac{5\sqrt{2} \cdot \sqrt{3}}{\sqrt{5} \cdot \sqrt{3}}$ $= \frac{5\sqrt{2}}{\sqrt{5}}$ $= \frac{5\sqrt{10}}{5}$ $= \boxed{\sqrt{10}}$	$14. \sqrt{\frac{10m^3}{18m}} = \sqrt{\frac{5m^2}{9}}$ $= \boxed{\frac{m\sqrt{5}}{3}}$	$15. \frac{(\sqrt{5}-\sqrt{2})\sqrt{2}}{4\sqrt{2} \cdot \sqrt{2}}$ $= \frac{\sqrt{10}-\sqrt{4}}{4\sqrt{4}} = \boxed{\frac{-2+\sqrt{10}}{8}}$
$16. \frac{(2)(5-3\sqrt{2})}{(5+3\sqrt{2})(5-3\sqrt{2})}$ $= \frac{10-6\sqrt{2}}{25-15\sqrt{2}+15\sqrt{2}-9\sqrt{4}}$ $= \frac{10-6\sqrt{2}}{25-18} = \boxed{\frac{10-6\sqrt{2}}{7}}$	$17. \frac{(2+\sqrt{7})(5+\sqrt{7})}{(5-\sqrt{7})(5+\sqrt{7})}$ $= \frac{10+2\sqrt{7}+5\sqrt{7}+\sqrt{49}}{25+5\sqrt{7}-5\sqrt{7}-\sqrt{49}}$ $= \frac{17+7\sqrt{7}}{25-7} = \boxed{\frac{17+7\sqrt{7}}{8}}$	

Topic 3: Rational Exponents

Rewrite in radical form. Simplify if possible.

$18. 16^{\frac{1}{4}} = \sqrt[4]{16}$ $= \boxed{2}$	$19. a^{\frac{2}{3}} = \sqrt[3]{a^2}$	$20. (2y)^{\frac{5}{2}} = \sqrt{(2y)^5}$ $= \sqrt{(2y)^4} \sqrt{2y}$ $= \boxed{4y^2 \sqrt{2y}}$
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Rewrite in exponential form.

$21. \sqrt[3]{17} = \boxed{17^{\frac{1}{3}}}$	$22. \sqrt[4]{(7x)^3} = \boxed{(7x)^{\frac{3}{4}}}$	$23. \sqrt{12a^9} = \boxed{(12a^9)^{\frac{1}{2}}}$
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Simplify each expression. Give final answers in simplest radical form.

$24. x^{\frac{1}{8}} \cdot x^{\frac{5}{8}} = a^{\frac{6}{8}}$ $= a^{\frac{3}{4}}$ $= \boxed{\sqrt[4]{a^3}}$	$25. (81^8)^{\frac{1}{4}} = 81^{-\frac{8}{4}}$ $= 81^{-2}$ $= \boxed{\frac{1}{6561}}$	$26. \frac{k^{\frac{10}{3}}}{k} = k^{\frac{7}{3}}$ $= \sqrt[3]{k^7}$ $= \sqrt[3]{k^6} \sqrt[3]{k} = \boxed{k^2 \sqrt[3]{k}}$
$27. \sqrt{m^9} \cdot \sqrt{m} = m^{\frac{9}{2}} \cdot m^{\frac{1}{2}}$ $= m^{\frac{10}{2}} = m^5$ $= \boxed{m^5}$	$28. \frac{2^3}{\sqrt{2^7}} = \frac{2^3}{2^{\frac{7}{2}}}$ $= \frac{2^3}{2^{\frac{7}{2}}}$ $= \frac{1}{2^{\frac{1}{2}}} = \boxed{\frac{\sqrt{2}}{2}}$	$29. \frac{\sqrt{x^3} \cdot \sqrt{x^3}}{x} = \frac{x^{\frac{3}{2}} \cdot x^{\frac{3}{2}}}{x}$ $= \frac{x^3}{x}$ $= x^2 = \boxed{\sqrt{x^4}}$

Topic 4: Solving Radical Equations

Solve each equation. Check for extraneous solutions.

<p>30. $\sqrt{5x-1}+4=11$</p> <p>$\sqrt{5x-1}=7$</p> <p>$5x-1=49$</p> <p>$5x=50$</p> <p>$x=10$</p> <p>ck</p> <p>$\sqrt{5(10)-1}+4=11$</p> <p>$7+4=11 \checkmark$</p>	<p>31. $1-2\sqrt{m+12}=5$</p> <p>$-2\sqrt{m+12}=4$</p> <p>$\sqrt{m+12}=-2$</p> <p>$m+12=4$</p> <p>$m=-8$</p> <p>ck</p> <p>$1-2\sqrt{-8+12}=5$</p> <p>$1-2\sqrt{4}=5$</p> <p>$1-4 \neq 5$</p> <p>NO SOLUTION</p>
<p>32. $(9a+45)^{\frac{1}{3}}=3$</p> <p>$9a+45=27$</p> <p>$9a=-18$</p> <p>$a=-2$</p> <p>ck</p> <p>$(-18+45)^{\frac{1}{3}}=3$</p> <p>$27^{\frac{1}{3}}=3 \checkmark$</p>	<p>33. $\sqrt{3n-27}=\sqrt{43-2n}$</p> <p>$3n-27=43-2n$</p> <p>$5n=70$</p> <p>$n=14$</p> <p>ck</p> <p>$\sqrt{42-27}=\sqrt{43-28}$</p> <p>$\sqrt{15}=\sqrt{15} \checkmark$</p>
<p>34. $(18+7k)^{\frac{1}{2}}=k$</p> <p>$18+7k=k^2$</p> <p>$0=k^2-7k-18$</p> <p>$0=(k-9)(k+2)$</p> <p>$k=9$ $k=-2$</p> <p>ck</p> <p>$(18+63)^{\frac{1}{2}}=9$</p> <p>$81^{\frac{1}{2}}=9 \checkmark$</p> <p>$(18-14)^{\frac{1}{2}}=-2$</p> <p>$4^{\frac{1}{2}} \neq -2$</p>	<p>35. $\sqrt{6x+19}-4=x$</p> <p>$\sqrt{6x+19}=x+4$</p> <p>$6x+19=x^2+8x+16$</p> <p>$0=x^2+2x-3$</p> <p>$0=(x+3)(x-1)$</p> <p>$x=-3$ $x=1$</p> <p>ck</p> <p>$\sqrt{-18+19}-4=-3$</p> <p>$1-4=-3 \checkmark$</p> <p>$\sqrt{6+19}-4=1$</p> <p>$5-4=1 \checkmark$</p>

Topic 5: Graphing Radical Functions

Identify the parent function and sketch the shape of the graph.

<p>SQUARE ROOT</p>		<p>CUBE ROOT</p>	
<p>$f(x) = \sqrt{x}$</p>		<p>$f(x) = \sqrt[3]{x}$</p>	

Describe the transformations on each function compared to its parent function.

36. $f(x) = \frac{3}{4}\sqrt{x} + 1$

Vert. Compression by $\frac{3}{4}$,
up 1

37. $f(x) = 2\sqrt[3]{x+5} - 8$

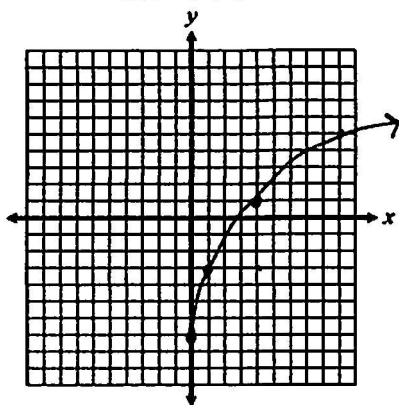
vert. stretch by 2, left +5,
down 8

38. The cubic parent function is reflected about the x-axis, then shifted so that its turning point is located at (-6, -2). Write an equation that represents this new function.

$$f(x) = -\sqrt[3]{x+6} - 2$$

Graph each function and identify its key characteristics.

39. $f(x) = 4\sqrt{x} - 7$



D: $\{x | x \geq 0\}$ R: $\{y | y \geq -7\}$

Endpoint/Turning Point: $(0, -7)$

End Behavior:

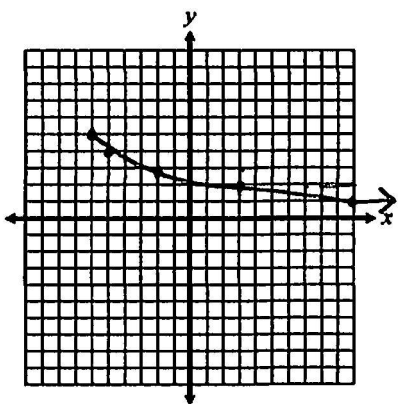
AS $x \rightarrow \infty$, $f(x) \rightarrow \infty$

AS $x \rightarrow 0$, $f(x) \rightarrow -7$

Increasing Interval(s): $[0, \infty)$

Decreasing Interval(s): $-$

40. $f(x) = -\sqrt{x+6} + 5$



D: $\{x | x \geq -6\}$ R: $\{y | y \leq 5\}$

Endpoint/Turning Point: $(-6, 5)$

End Behavior:

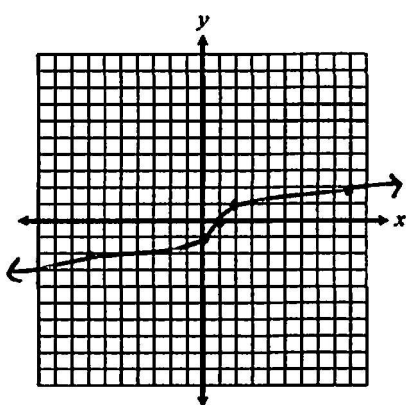
AS $x \rightarrow \infty$, $f(x) \rightarrow -\infty$

AS $x \rightarrow -6$, $f(x) \rightarrow 5$

Increasing Interval(s): $-$

Decreasing Interval(s): $[-6, \infty)$

41. $f(x) = \sqrt[3]{x-1}$



D: \mathbb{R} R: \mathbb{R}

Endpoint/Turning Point: $(1, 0)$

End Behavior:

AS $x \rightarrow \infty$, $f(x) \rightarrow \infty$

AS $x \rightarrow -\infty$, $f(x) \rightarrow -\infty$

Increasing Interval(s): $(-\infty, \infty)$

Decreasing Interval(s): $-$