INTERMEDIATE ALGEBRA

GPS # 30 **7.1 RADICAL EXPRESSIONS AND RATIONAL EXPONENTS** NAME: Parul Patel

2/ Good
no Calc.

Useful Guidelines:

- * $\sqrt[n]{a} = a^{\frac{1}{n}} = b$ means $a = b^n$, where $\sqrt[n]{a}$ is the principal n^{th} root of a.
- * $\sqrt[n]{a^n} = |a|$ if n is even. For example: $\sqrt[4]{(-3)^4} = |(-3)| = 3$.
- * $\sqrt[n]{a^n} = a$ if n is odd. For example: $\sqrt[3]{(-5)^3} = -5$.

[Remember: $(a^n)^m = a^{nm}$, $a^m a^n = a^{m+n}$ and $\dfrac{a^m}{a^n} = a^{m-n}$]

Rational Exponents:

* If m and n are positive integers with $\frac{m}{n}$ in lowest term, then $a^{m/n} = \sqrt[n]{a^m} = (\sqrt[n]{a})^m$.

[Remember: $(ab)^m = a^m b^m$, $\left(\dfrac{a}{b}\right)^m = \dfrac{a^m}{b^m}$, $a^{-n} = \dfrac{1}{a^n} = \left(\dfrac{1}{a}\right)^n$]

Simplify each root so that no radicals appear. Assume all variables represents real numbers.

1. a) $\sqrt{81}$ $= (9^{\cancel{2}})^{\frac{1}{2}}$ $\boxed{=9}$

b) $\sqrt[3]{8}$ $(2^3)^{\frac{1}{3}}$ $\boxed{=2}$

c) $\sqrt[5]{32}$ $32^{\frac{1}{5}}$ $=(2^5)^{\frac{1}{5}}$ $\boxed{=2}$

even Roots $\sqrt[4]{}$ $\sqrt[6]{}$ absolute value

d) $\sqrt[4]{(-3)^4}$ $=(-3^4)^{\frac{1}{4}}$ $=|-3|$ $\boxed{=3}$

e) $-\sqrt[3]{(-5)^3}$ $= -(-5^{\cancel{3}})^{\frac{1}{3}}$ $\boxed{=5}$

f) $-\sqrt[4]{(-2)^4}$ $= -(-2^4)^{\frac{1}{4}}$ $=-|2|$ $\boxed{=-2}$

2. a) $\sqrt{5^2}$ $=(5^{\cancel{2}})^{\frac{1}{2}}$ $\boxed{=5}$

b) $\sqrt[2]{(-5)^2}$ $=|-5|$ $\boxed{=5}$

c) $\sqrt[6]{(-5)^6}$ $=|-5|$ $\boxed{=5}$

d) $\sqrt[2]{x^2}$ $\boxed{=|x|}$

e) $\sqrt[3]{x^9}$ $=(x^9)^{\frac{1}{3}}$ $\boxed{=x^3}$

f) $-\sqrt[3]{27t^3}$ $= -(3t)^{\cancel{3}\cdot\frac{1}{3}}$ $\boxed{=-3t}$

g) $\sqrt[5]{32k^5}$ $=(2k^{\cancel{5}})^{\frac{1}{5}}$ $\boxed{=2k}$

h) $-\sqrt{x^2}$ $\boxed{=-|x|}$ ← absolute value $\boxed{=-x}$

Evaluate the following, simplify if possible, and write the answer with only positive exponents.

3. a) $8^{4/3}$ $=(2^3)^{\frac{4}{3}}$ $=2^4$ $\boxed{=16}$

b) $(16)^{3/4}$ $=(2^4)^{\frac{3}{4}}$ $=2^3$ $\boxed{=8}$

flip to make $- \to +$

c) $\left(\dfrac{1000}{27}\right)^{-4/3}$ $\left(\dfrac{27}{1000}\right)^{+\frac{4}{3}}$ $=\left(\left(\dfrac{3}{10}\right)^3\right)^{\frac{4}{3}}$ $=\dfrac{3^4}{10^4}$ $=\dfrac{81}{10000}$

d) $-\left(\dfrac{16}{81}\right)^{3/4}$ $= -\left(\left(\dfrac{2}{3}\right)^4\right)^{\frac{3}{4}}$ $= -\dfrac{8}{27}$

4. a) $3^{1/3} \cdot 3^{5/3}$ $=3^{\frac{1}{3}+\frac{5}{3}}$ $=3^{\frac{6}{3}}$ $=3^2$ $=9$

b) $x^{-1/2}(x^{5/2}+x)$ $=x^{-\frac{1}{2}+\frac{5}{2}} + x^{-\frac{1}{2}+1}$ $=x^{\frac{4}{2}}+x^{\frac{1}{2}}$ $=x^2+x^{\frac{1}{2}}$ $=x^2+\sqrt{x}$

5 a) $\dfrac{t^{5/6} \cdot t^{-2/6}}{t}$ $= t^{\frac{5}{6}-\frac{2}{6}-1}$ $= t^{\frac{5-2-6}{6}}$ $= t^{-\frac{3}{6}}$ $= t^{-\frac{1}{2}}$ $=\dfrac{1}{t^{1/2}}$ $=\dfrac{1}{\sqrt{t}}$

xb) $\sqrt[3]{x^4} \cdot \sqrt[3]{x^6}$ $= x^{4\cdot\frac{1}{3}} \cdot x^{6\cdot\frac{1}{3}}$ $= x^{\frac{4}{3}} \cdot x^2$ $= x^{\frac{4}{3}+2}$ $= x^{\frac{4+6}{3}}$ $= x^{\frac{10}{3}}$

or $\sqrt[3]{x^4 \cdot x^6} = \sqrt[3]{x^{10}}$

[illegible]

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INTERMEDIATE ALGEBRA

GPS # 31 **7.2 SIMPLIFYING RADICAL EXPRESSIONS** **NAME:** Paru Patel

20/20

Useful Guidelines:

If $\sqrt[n]{a}$ and $\sqrt[n]{b}$ are real numbers, and $b \neq 0$ and n is a natural number, then

* $\sqrt[n]{a}\cdot\sqrt[n]{b} = \sqrt[n]{ab}$ and $\sqrt[n]{\frac{a}{b}} = \frac{\sqrt[n]{a}}{\sqrt[n]{b}}$. For example: $\sqrt[4]{8}\cdot\sqrt[4]{2} = \sqrt[4]{8\cdot 2} = 2$ and $\sqrt[3]{\frac{8}{27}} = \frac{\sqrt[3]{8}}{\sqrt[3]{27}} = \frac{2}{3}$

* Rationalizing the Denominator:
Writing the quotient without a radical expression in the denominator.

Evaluate the following:

1. a) $\sqrt[3]{9}\cdot\sqrt[3]{3} = \sqrt[3]{9\cdot 3}$ $= \sqrt[3]{27}$ $\boxed{= 3}$

b) $\sqrt[3]{16}\cdot\sqrt[3]{4} = \sqrt[3]{16\cdot 4}$ $= \sqrt[3]{64}$ $\boxed{= 4}$

c) $\sqrt[5]{9t}\cdot\sqrt[5]{5} = \boxed{\sqrt[5]{45t}}$

d) $\sqrt{4m}\cdot\sqrt{3pq} =$ $\sqrt{12mpq}$

e) $\sqrt[4]{10}\cdot\sqrt[4]{5} =$ $\boxed{\sqrt[4]{50}}$

f) $\sqrt[5]{4x}\cdot\sqrt[3]{y} =$ Can't Simplify

Assume all variables represent positive real numbers. Simplify the following (if possible):

2. a) $\sqrt[3]{-\frac{64}{8}} = \left(\left(\frac{-4}{2}\right)^{3}\right)^{\frac{1}{3}}$ $= -\frac{4}{2}$ $= \boxed{-2}$

b) $\sqrt{\frac{81}{49}} = \frac{9}{7}$

c) $\sqrt[4]{\frac{81}{16}} = \left(\frac{3}{2}\right)^{4\cdot\frac{1}{4}}$ $= \frac{3}{2}$

d) $\sqrt[3]{-\frac{k^9}{125}} = \left(\left(\frac{-k^3}{5}\right)^{3}\right)^{\frac{1}{3}}$ $= \frac{-k^3}{5}$

e) $\sqrt{\frac{64m^4}{a^2}} = \frac{\sqrt{64m^4}}{\sqrt{a^2}}$ $= \frac{8m^2}{a}$

f) $\sqrt[4]{\frac{x^4}{16y^8}} = \frac{x}{2y^2}$ $(2y^2)^4$

3. a) $\sqrt[3]{54} = \sqrt[3]{(2)(27)}$
$= \sqrt[3]{2}\cdot\sqrt[3]{27}$
$= 3\cdot\sqrt[3]{2}$

b) $-\sqrt[3]{32} = -\sqrt[3]{(8)(4)}$
$= -\sqrt[3]{2^3}\cdot\sqrt[3]{4}$
$= -2\sqrt[3]{4}$

c) $-\sqrt{11} =$ Can't Simplify

d) $\sqrt{4x^3} = \sqrt{4\cdot x^3}$
$= \sqrt{4}\cdot\sqrt{x^3}$
$\boxed{= 2\sqrt{x^3}}$

e) $\sqrt[3]{27p^5q^4} = \sqrt[3]{27}\,\sqrt[3]{p^5q^4}$
$= 3\,\sqrt[3]{p^3p^2q^3q^1}$
$\boxed{= 3pq\,\sqrt[3]{p^2q}}$

f) $-\sqrt[4]{32a^5} = -\sqrt[4]{16\cdot 2\cdot a^4\cdot a^1}$
$\boxed{= -2a\sqrt[4]{2a}}$

4. Rationalize each denominator. Assume that all variables are positive.

a) $\frac{7}{\sqrt{3}}\cdot\frac{\sqrt{3}}{\sqrt{3}} = \frac{7\sqrt{3}}{3}$

b) $\frac{5}{2\sqrt{2}}\cdot\frac{\sqrt{2}}{\sqrt{2}}\cdot\frac{5\sqrt{2}}{4}$

c) $\frac{7\sqrt{3}}{\sqrt{5}}\cdot\frac{\sqrt{5}}{\sqrt{5}} = \frac{7\sqrt{15}}{5}$

d) $\frac{4\sqrt{a}}{\sqrt{b}}\cdot\frac{\sqrt{b}}{\sqrt{b}} = \frac{4\sqrt{ab}}{b}$

e) $\sqrt{\frac{9m^2}{n}} = \frac{\sqrt{9m^2}}{\sqrt{n}} = \frac{3m}{\sqrt{n}}\cdot\frac{\sqrt{n}}{\sqrt{n}}$
$\boxed{= \frac{3m\sqrt{n}}{n}}$

f) $\frac{2xy}{\sqrt{x^3}} = \frac{2\cancel{x}y}{\cancel{x}\sqrt{x}} = \frac{2y}{\sqrt{x}}\cdot\frac{\sqrt{x}}{\sqrt{x}}$
$\boxed{= \frac{2y\sqrt{x}}{x}}$

INTERMEDIATE ALGEBRA

GPS # 32 7.3 OPERATIONS ON RADICAL EXPRESSIONS I **NAME:** Parul Patel

Useful Guidelines:

If $\sqrt[n]{a}$ and $\sqrt[n]{b}$ are real numbers, and $b \neq 0$ and n is a natural number, then

* $\sqrt[n]{a} \cdot \sqrt[n]{b} = \sqrt[n]{ab}$ and $\sqrt[n]{\frac{a}{b}} = \frac{\sqrt[n]{a}}{\sqrt[n]{b}}$. For example: $\sqrt[4]{8} \cdot \sqrt[4]{2} = \sqrt[4]{8 \cdot 2} = 2$ and $\sqrt[3]{\frac{8}{27}} = \frac{\sqrt[3]{8}}{\sqrt[3]{27}} = \frac{2}{3}$

* NOTE: $\sqrt[n]{a} + \sqrt[n]{b} \neq \sqrt[n]{a+b}$ and $\sqrt[n]{a} - \sqrt[n]{b} \neq \sqrt[n]{a-b}$

Only radical expression with the same index and the same radicand may be combined (combining the like terms or same family only).

For example: $\sqrt[3]{5} + 2\sqrt[3]{5} + 4\sqrt[3]{7} + 2\sqrt[3]{7} = 3\sqrt[3]{5} + 6\sqrt[3]{7}$.

Assume all variables represent positive real numbers. Simplify the following (if possible):

1. a) $\sqrt[3]{15} + 6\sqrt[3]{15}$

$\boxed{= 7\sqrt[3]{15}}$

b) $\sqrt{20} - \sqrt{45}$ $\sqrt{4 \cdot 5} - \sqrt{9 \cdot 5}$

$= 2\sqrt{5} - 3\sqrt{5}$

$\boxed{= -\sqrt{5}}$

c) $2\sqrt{45a} + \sqrt{20a}$

$= 2\sqrt{9 \cdot 5a} + \sqrt{5 \cdot 4a}$

$= 2 \cdot 3\sqrt{5a} + 2\sqrt{5a}$

$= 6\sqrt{5a} + 2\sqrt{5a}$ $\boxed{= 8\sqrt{5a}}$

d) $3\sqrt{5} - 5\sqrt{2}$

can't Simplify

2. a) $3\sqrt[3]{16} - 2\sqrt[3]{250}$

$= 3 \cdot \sqrt[3]{8 \cdot 2} - 2\sqrt[3]{125 \cdot 2}$

$= 3 \cdot 2\sqrt[3]{2} - 2 \cdot 5\sqrt[3]{2}$

$= 6\sqrt[3]{2} - 10\sqrt[3]{2}$

$\boxed{= -4\sqrt[3]{2}}$

b) $5\sqrt{12} - 3\sqrt{27}$

$= 5\sqrt{4 \cdot 3} - 3\sqrt{9 \cdot 3}$

$= 5 \cdot 2\sqrt{3} - 3 \cdot 3\sqrt{3}$

$= 10\sqrt{3} - 9\sqrt{3}$

$\boxed{= \sqrt{3}}$

c) $\sqrt[4]{81x^2y} + \sqrt[4]{16x^6y^5}$

$= 3\sqrt[4]{x^2y} + 2xy\sqrt[4]{x^2y}$

$\boxed{= (3 + 2xy)\sqrt[4]{x^2y}}$

d) $\sqrt[3]{8m^2n} + 3\sqrt[3]{m^5n^7}$

$= 2 \cdot \sqrt[3]{m^2n} + 3mn^2\sqrt[3]{m^2n}$

$\boxed{= (2 + 3mn^2)\sqrt[3]{m^2n}}$

3. a) $2\sqrt{\frac{32}{25}} + 3\sqrt{\frac{32}{\cancel{8}}}$ 4

$= 2\frac{\sqrt{32}}{\sqrt{25}} + 3 \cdot 2 = 2\frac{\sqrt{16 \cdot 2}}{5} + 6 = \frac{8\sqrt{2}}{5} + 6$ $\boxed{= \frac{8\sqrt{2} + 30}{5}}$

c) $\sqrt[3]{\frac{8x^3}{x^{12}}} + \sqrt[3]{\frac{16}{x^9}}$

$= \frac{2\cancel{x}}{\cancel{x}^{4}_{x^3}} + \frac{\sqrt[3]{8 \cdot 2}}{\sqrt[3]{x^9}} = \frac{2}{x^3} + \frac{2\sqrt[3]{2}}{x^3} = \boxed{\frac{2 + 2\sqrt[3]{2}}{x^3}}$

can't add 2+2 dt different object.

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GPS # 33 7.3 OPERATIONS ON RADICAL EXPRESSIONS II NAME: Parul Patel

20/20

Useful Guidelines:

* To rationalize denominator with one radical term:
Multiply both the numerator and the denominator by that radical term in the denominator.

For example: $\frac{3}{\sqrt{5}}=\frac{3}{\sqrt{5}}\cdot\frac{\sqrt{5}}{\sqrt{5}}=\frac{3\sqrt{5}}{5}$

* To rationalize denominator with binomials involving radicals:
Multiply both the numerator and the denominator by the conjugate of the denominator.

For example: $\frac{3}{4+\sqrt{5}}=\frac{3}{(4+\sqrt{5})}\cdot\frac{(4-\sqrt{5})}{(4-\sqrt{5})}=\frac{3(4-\sqrt{5})}{16-5}=\frac{3(4-\sqrt{5})}{11}$

Rationalize the denominator in each expression. Assume all variables represent positive real numbers.

1. a) $\frac{2}{\sqrt{2}}\cdot\frac{\sqrt{2}}{\sqrt{2}}=\frac{2\sqrt{2}}{2}\ \boxed{=\sqrt{2}}$

b) $\frac{12}{\sqrt{7}}\cdot\frac{\sqrt{7}}{\sqrt{7}}\ \boxed{=\frac{12\sqrt{7}}{7}}$

c) $\sqrt{\frac{3}{11}}=\frac{\sqrt{3}}{\sqrt{11}}\cdot\frac{\sqrt{11}}{\sqrt{11}}\ \boxed{=\frac{\sqrt{33}}{11}}$

d) $-\sqrt{\frac{13}{x}}=-\frac{\sqrt{13}}{\sqrt{x}}\cdot\frac{\sqrt{x}}{\sqrt{x}}$

$\boxed{=-\frac{\sqrt{13x}}{x}}$

to get 2 as ans.

$\sqrt[3]{2}\cdot\sqrt[3]{2}\cdot\sqrt[3]{2}$

$=2^{\frac{1}{3}+\frac{1}{3}+\frac{1}{3}}$

$=2^{1}$

$=2$

e) $\sqrt[3]{\frac{27}{2}}=\frac{3}{\sqrt[3]{2}}\cdot\frac{\sqrt[3]{4}}{\sqrt[3]{4}}$

$=\frac{3\sqrt[3]{4}}{\sqrt[3]{8}}=\frac{3\sqrt[3]{4}}{2}$

f) $-\sqrt[4]{\frac{16}{y}}=-\left|\frac{2}{\sqrt[4]{y}}\right|$

So. $\frac{-2}{\sqrt[4]{y}}\cdot\frac{\sqrt[4]{y^3}}{\sqrt[4]{y^3}}\ \boxed{=\frac{-2\sqrt[4]{y^3}}{y}}$

Rationalize the denominator in each expression. Assume all variables represent positive real numbers and no denominators are 0.

Use
Diff of Squars
$(x-y)(x+y)$
$=x^2-y^2$

multiply
by conjugate

2. a) $\frac{8}{3-\sqrt{5}}\cdot\frac{(3+\sqrt{5})}{(3+\sqrt{5})}$

$=\frac{24+8\sqrt{5}}{3^2-\sqrt{5}^2}$

$=\frac{24+8\sqrt{5}}{9-5}=\frac{\overset{6}{\cancel{24}}+\overset{2}{\cancel{8}}\sqrt{5}}{\cancel{4}}\ \boxed{=6+2\sqrt{5}}$

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

$\boxed{=\frac{4\sqrt{3}+4\sqrt{2k}}{3-2k}}$

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

By foil $\boxed{=\frac{2\sqrt{2}-2\sqrt{3}-\sqrt{6}+3}{4-3(1)}}$

$\boxed{=2\sqrt{2}-2\sqrt{3}-\sqrt{6}+3}$

d) $\frac{3+\sqrt{2x}}{(\sqrt{3}-\sqrt{2x})}\cdot\frac{(\sqrt{3}+\sqrt{2x})}{(\sqrt{3}+\sqrt{2x})}$ difference of square

$=\frac{3\sqrt{3}+\sqrt{6x}+3\sqrt{2x}+2x}{3-2x}$

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INTERMEDIATE ALGEBRA

GPS # 34 **7.4 RADICAL FUNCTIONS** NAME: Parul Patel

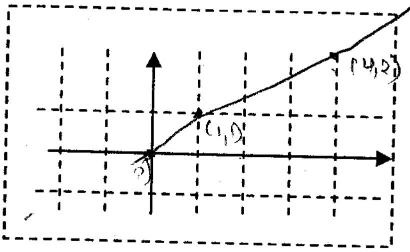
Useful Guidelines:

- Square Root and Cube Root: The cube root function is defined for all inputs, whereas the square root function is defined only for nonnegative inputs.
- Square Root Property: If k is a nonnegative numbers and $x^2 = k$, then $x = \pm\sqrt{k}$.
- Solve Equations with Cube Roots: The solution to the equation $x^3 = k$ is $x = \sqrt[3]{k}$.
- Power function: $f(x) = x^p$, where p is a rational number.
- Root function: $f(x) = \sqrt[n]{x}$, where $n \geq 2$.

1. Graph each function. Give the domain and the range.

a. $f(x) = \sqrt{x}$ D: [0, ∞) R: [0, ∞)

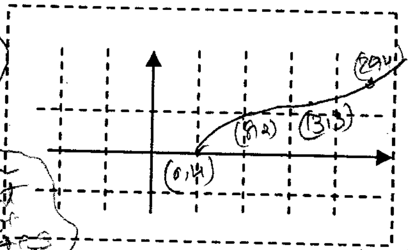
x	y(√x)
0	0
1	1
4	2
9	3



moves side ways when constant in side of Ruts

b. $f(x) = \sqrt{x-4}$ D: [4, ∞) R: [0, ∞)

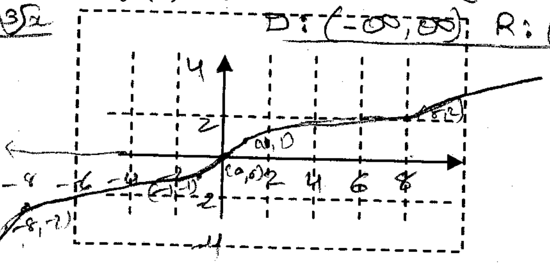
x	y √x-4
4	0
8	2
13	3
20	4



moves up & down when constant outside of Ruts

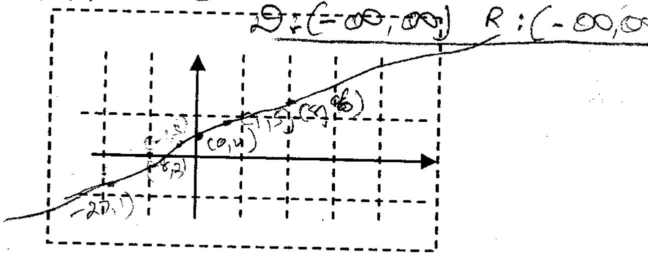
c. $f(x) = \sqrt[3]{x}$ include negative part. D: (-∞, ∞) R: (-∞, ∞)

x	y ∛x
0	0
1	1
8	2
27	3
-1	-1
-8	-2
-27	-3



x	y ∛x + 4
0	4
1	5
8	6
27	7
-1	3
-8	2
-27	1

d. $f(x) = \sqrt[3]{x} + 4$ goes up 4 point on Y-axis D: (-∞, ∞) R: (-∞, ∞)



2. Use the square root property to solve each equation and give the solution set.

a) $x^2 = 49$

$x = \pm\sqrt{49}$

$x = \pm 7$

sol. set {x | x = ±7}

b) $x^2 - 8 = 0$

$x^2 = 8$

$x = \pm\sqrt{8}$ (4·2)

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

Sol Set = {x | x ± 2√2}

c) $(x-4)^2 = 25$

$x - 4 = \pm\sqrt{25}$

$x - 4 = \pm 5$

$x - 4 = 5$ | $x - 4 = -5$

$\boxed{x = 9}$ | $\boxed{x = -1}$

Sol. Set {x | x = 9 or x = -1}

d) $(2x-5)^2 = 12$

$2x - 5 = \pm\sqrt{4 \cdot 3}$

$2x - 5 = \pm 2\sqrt{3}$

$2x - 5 = 2\sqrt{3}$ | $2x - 5 = -2\sqrt{3}$

$2x = 5 + 2\sqrt{3}$ | $2x = 5 - 2\sqrt{3}$

$\boxed{x = \frac{5 + 2\sqrt{3}}{2}}$ | $\boxed{x = \frac{5 - 2\sqrt{3}}{2}}$

Sol. set {x | x $\frac{5 \pm 2\sqrt{3}}{2}$}

3. Use the cube roots to solve each equation and give the solution set.

a) $x^3 = 125$

$x = \sqrt[3]{125}$

x = {x | x = 5}

b) $\frac{3(y-1)^3}{3} = \frac{81}{3}$

$y - 1 = \sqrt[3]{27}$

$y - 1 = 3$

$\boxed{y = 4}$ Sol set {x | x = 4}

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GPS # 36 **7.6 COMPLEX NUMBERS** NAME: Paru Patel

Useful Guidelines:

- * Imaginary Unit: $i = \sqrt{-1}$ and $i^2 = -1$. Example: $\sqrt{-5} = i\sqrt{5}$. i = imaginary number
- * Standard Form: $a + bi$, where a and b are real numbers.
- * Real Part of $a + bi$: a
- * Imaginary Part of $a + bi$: b
- * Complex conjugate of $a + bi$: $a - bi$

20/20

1. Use the imaginary unit to write the expression.

a. $\sqrt{-36} = \sqrt{(-1)(36)}$

$= \boxed{\sqrt{-1}}\sqrt{36} = i6$

c. $\sqrt{-72}$

$\sqrt{(-1)(36)2} = 6\sqrt{2}\,i$

b. $\sqrt{-81}$ $= \sqrt{-1}, \sqrt{81}$ $= 9i$

d. $\sqrt{-20}$

$= \sqrt{(-1)(4)(5)}$ $= i2\sqrt{5}$

2. Write each sum or difference in standard form.

a. $(2 + i) + (9 - 2i)$

$\boxed{= 11 - i}$

c. $(-3 + 2i) + (4 - 4i)$

$= -3 + 2i + 4 - 4i$ $\boxed{= 1 - 2i}$

b. $(4 - 5i) - (1 - i)$

$= 4 - 5i - 1 + i$ $\boxed{= 3 - 4i}$

d. $(6 - 5i) - (2 + 5i)$

$\boxed{4 - 10i}$

3. Write each product in standard form.

a. $(3 - i)(2 + 2i)$

$= 6 - 2i + 6i - 2i^2$

$= 6 + 4i - 2(-1)$

real num → $= 8 + 4i$ ← imaginary number

c. $(-4 + 3i)(2 + 8i)$

$= -12 + 6i - 32i + 24i^2$

$= -12 - 26i + 24(-1)$

$\boxed{= -36 - 26i}$

b. $(7 + i)(5 - 2i)$

$= 35 + 5i - 14i - 2i^2$

$= 35 - 9i - 2(-1)$

$\boxed{= 37 - 9i}$

d. $(5 - 4i)(1 - 3i)$

$= 5 - 4i - 15i + 12i^2$

$= 5 - 19i + 12(-1)$

$\boxed{= -7 - 19i}$

4. Write each quotient in standard form.

a. $\frac{3}{4 - 3i} \cdot \frac{(4 + 3i)}{(4 + 3i)}$

$= \frac{12 + 9i}{16 - 9i^2}$

$= \frac{12 + 9i}{16 - 9(-1)}$

$= \frac{12 + 9i}{25}$

$= \underbrace{\frac{12}{25}}_{\text{Real \#}} + \underbrace{\frac{9}{25}}_{\text{imaginary \#}}i$

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

$= \frac{6 - 3i - 8i + 4i^2}{9 - 16i^2}$

$= \frac{6 - 11i + 4(-1)}{9 + 16}$

$= \frac{2 - 11i}{25}$

$= \frac{2}{25} - \frac{11}{25}i$

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

$= \frac{4i - 10i^2}{4 - 25i^2}$

$= \frac{4i - 10(-1)}{4 + 25}$

$= \frac{4i + 10}{29}$

$= \frac{10}{29} + \frac{4}{29}i$

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

$= \frac{-5i - 10i^2}{-25i^2}$

$= \frac{-5i - 10(-1)}{-25(-1)}$

$= \frac{-5i + 10}{25}$

$= \frac{\overset{2}{\cancel{10}}}{\underset{5}{\cancel{25}}} - \frac{\cancel{5}}{\underset{5}{\cancel{25}}}i$

$\boxed{= \frac{2}{5} - \frac{1}{5}i}$