Serial #: ________ ID ______________ NAME ____

Show all necessary steps for full marks.

Question 1: (5 points): Simplify the following expressions: (Assume $a \neq 0,\ b \neq 0,$ and $c \neq 0$)

(a): $\left|-2^{-3^2}\right|$ **(b):** $\dfrac{(a+b)^{-1}}{a^{-1}+b^{-1}}$ **(c):** $\left(a^{-1}-b^{-1}\right)^2(a-b)^{-2}$ **(d):** $\dfrac{\left(-2a^{-1}bc^{-2}\right)^{-2}}{\left(3^{-1}b\right)\left(2^{-1}ac^{-2}\right)^3}$

Solution:

(a): $\left|-2^{-3^2}\right| = 2^{-3^2} = 2^{-9} = \dfrac{1}{2^9}$

(b): $\dfrac{(a+b)^{-1}}{a^{-1}+b^{-1}} = \dfrac{\frac{1}{a+b}}{\frac{1}{a}+\frac{1}{b}} = \dfrac{\frac{1}{a+b}}{\frac{b+a}{ab}} = \dfrac{1}{a+b}\cdot\dfrac{ab}{b+a} = \dfrac{ab}{(a+b)^2}$

(c): $\left(a^{-1}-b^{-1}\right)^2(a-b)^{-2} = \dfrac{\left(a^{-1}-b^{-1}\right)^2}{(a-b)^2} = \dfrac{\left(\frac{1}{a}-\frac{1}{b}\right)^2}{(a-b)^2} = \dfrac{\left(\frac{b-a}{ab}\right)^2}{(a-b)^2} = \dfrac{\frac{(b-a)^2}{a^2b^2}}{(a-b)^2} = \dfrac{(b-a)^2}{a^2b^2}\cdot\dfrac{1}{(a-b)^2} = \dfrac{1}{a^2b^2}$

(d): $\dfrac{\left(-2a^{-1}bc^{-2}\right)^{-2}}{\left(3^{-1}b\right)\left(2^{-1}ac^{-2}\right)^3} = \dfrac{(-2)^{-2}\cdot a^2\cdot b^{-2}\cdot c^4}{3^{-1}\cdot b\cdot 2^{-3}\cdot a^3\cdot c^{-6}} = \dfrac{3\cdot 2^3\cdot a^2\cdot c^4\cdot c^6}{(-2)^2\cdot a^3\cdot b\cdot b^2} = \dfrac{3\cdot 8\cdot c^{4+6}}{4\cdot a^{3-2}\cdot b^{1+2}} = \dfrac{6\cdot c^{10}}{a\cdot b^3}$

Question 2: (5 points): **(P.4 Textbook Exercises 39, 62 and 84):** Simplify the following expressions (Assume that all letters denote positive numbers.)

(a): $\sqrt{32}+\sqrt{18}$ **(b):** $\dfrac{x^{3/4}x^{7/4}}{x^{5/4}}$ **(c):** $\dfrac{(2y^{4/3})^2y^{-2/3}}{y^{7/3}}$ **(d):** $\sqrt{s\sqrt{s^3}}$

Solution:

(a): $\sqrt{32}+\sqrt{18} = \sqrt{16(2)}+\sqrt{9(2)} = 4\sqrt{2}+3\sqrt{2} = 7\sqrt{2}$

(b): $\dfrac{x^{3/4}x^{7/4}}{x^{5/4}} = x^{\frac{3}{4}+\frac{7}{4}-\frac{5}{4}} = x^{\frac{5}{4}}$

(c): $\dfrac{(2y^{4/3})^2y^{-2/3}}{y^{7/3}} = \dfrac{4y^{8/3}y^{-2/3}}{y^{7/3}} = 4y^{\frac{8}{3}-\frac{2}{3}-\frac{7}{3}} = 4y^{-1/3} = \dfrac{4}{y^{1/3}}\cdot\dfrac{y^{2/3}}{y^{2/3}} = \dfrac{4y^{2/3}}{y}$

(d): $\sqrt{s\sqrt{s^3}} = \left(s\cdot s^{3/2}\right)^{1/2} = \left(s^{1+\frac{3}{2}}\right)^{1/2} = \left(s^{5/2}\right)^{1/2} = s^{5/4}$

Question 3: (5 points): If the coefficient of x^4 in the product $(bx^2+x)\left(3x^4-2x^3+x^2+1\right)$ is equal to zero, then find the value of b

Solution: The product of bx^2 and x^2 is bx^4. The product of x and $-2x^3$ is $-2x^4$.

$$bx^4-2x^4=(b-2)x^4$$
$$b-2=0$$
$$b=2$$

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Question 4: (5 points): If $M = \dfrac{2}{1+\sqrt{3}-\sqrt{12}}$ and $N = 8\cdot\sqrt[3]{\dfrac{3}{16}}$, then $M + N = ?$

Solution:

21) If $M = \dfrac{2}{1+\sqrt{3}-\sqrt{12}}$ and $N = 8.\sqrt[3]{\dfrac{3}{16}}$, then $M + N =$

✓A) $-1-\sqrt{3}+2\sqrt[3]{12}$
B) $-2-\sqrt{3}+\sqrt[3]{6}$
C) $2-\sqrt{3}+2\sqrt[3]{12}$
D) $-1-\sqrt{3}+\sqrt[3]{3}$
E) $2-\sqrt{3}+\sqrt[3]{6}$

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

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

$$= \frac{2(1+\sqrt{3})}{-2} = -(1+\sqrt{3})$$

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

$$= \frac{8\sqrt[3]{12}}{(2)(2)} = 2\sqrt[3]{12}$$

$$\therefore\ M + N = -1-\sqrt{3}+2\sqrt[3]{12}$$