

1.3 Exponent Rules

Q1d Simplify the following.

$$\textcircled{1} i^{75} = -i$$

$$i = \sqrt{-1} \rightarrow .25$$

$$i^2 = -1 \rightarrow .50$$

$$i^3 = -i \rightarrow .75$$

$$i^4 = 1 \rightarrow 0$$

$$\frac{75}{4} = 18.75$$

$$\begin{aligned}\textcircled{2} (3+6i)(4-2i) &= 12 - 6i + 24i - 12i^2 \\ &= 12 + 18i - 12(-1) \\ &= 12 + 12 + 18i \\ &= 24 + 18i\end{aligned}$$

$$\begin{aligned}\textcircled{3} (3a-1)(a+2) &= 3a^2 + 6a - 1a - 2 \\ &= 3a^2 + 5a - 2\end{aligned}$$

$$\begin{aligned}\textcircled{4} \frac{2+i}{3+4i} \cdot \frac{3-4i}{3-4i} &= \frac{6-8i+3i-4i^2}{9-16(-1)} = \frac{6-5i-4(-1)}{9-16(-1)} = \frac{6+4-5i}{9+16} \\ &= \frac{10-5i}{25} = \frac{2}{5} - \frac{1}{5}i\end{aligned}$$

new Exponent Rules

1. Product Rule \Rightarrow Add Exponents

$$x^a \cdot x^b = x^{a+b}$$

(Example) $x^3 \cdot x^5 = x^8$

2. Quotient Rule \Rightarrow Subtract Exponents

$$\frac{x^a}{x^b} = x^{a-b}$$

(Example) $\frac{x^5}{x^3} = x^2$

3. Power raised to a Power \Rightarrow Multiply Exponents

$$(x^a)^b = x^{a \cdot b}$$

(Example) $(x^3)^5 = x^{15}$

4. Negative Exponents \Rightarrow move it to the other part of the fraction & it's no longer negative

$$x^{-n} = \frac{1}{x^n} \quad \text{or} \quad \frac{1}{x^{-n}} = x^n$$

[Examples] Simplify.

① $(-3c^4)^2 = 9c^8$

② $(4x^2y^3)^3 = 64x^6y^9$

③ $\frac{x^{12}y^4}{x^{20}y} = x^{-8}y^3 = \frac{y^3}{x^8}$

④ $\frac{24x^4y^6}{-8x^3y^7} = -3xy^{-1} = -\frac{3x}{y}$

⑤ $\frac{1}{9x^2y^{-1}} = \frac{x^2y^1}{9}$

⑥ $(4a^2b)^3 \cdot (ab)^3$
 $= 64a^6b^3 \cdot a^3b^3$
 $= 64a^9b^6$

$$\textcircled{7} \left(\frac{3x^2z^4}{2xz} \right)^3 = \frac{27x^6z^{12}}{8x^3z^3} = \frac{27x^3z^9}{8}$$

$$\textcircled{8} \frac{3a^7b^{-5}}{27a^{-3}b^8} = \frac{3a^7a^3}{27b^8b^5} = \frac{1a^{10}}{9b^{13}}$$