

Simplifying, Adding and Subtracting using Imaginary Numbers Worksheet

Express each number in terms of i , and simplify.

$$\begin{aligned} 1. \sqrt{-36} &= \sqrt{36 \cdot -1} \\ &= \sqrt{36} \sqrt{-1} \\ &= 6i \end{aligned}$$

$$\begin{aligned} 2. \sqrt{-100} &= \sqrt{100 \cdot -1} \\ &= \sqrt{100} \sqrt{-1} \\ &= 10i \end{aligned}$$

$$\begin{aligned} 3. -\sqrt{-81} &= -\sqrt{81 \cdot -1} \\ &= -\sqrt{81} \sqrt{-1} \\ &= -9i \end{aligned}$$

$$\begin{aligned} 4. 2\sqrt{-49} &= 2\sqrt{49 \cdot -1} \\ &= 2\sqrt{49} \sqrt{-1} \\ &= 2(7)i \\ &= 14i \end{aligned}$$

$$\begin{aligned} 5. \frac{1}{8}\sqrt{-64} &= \frac{1}{8}\sqrt{64} \sqrt{-1} \\ &= \frac{1}{8}(8)i \\ &= 1i \text{ or } i \end{aligned}$$

$$\begin{aligned} 6. -\frac{2}{3}\sqrt{-9} &= -\frac{2}{3}\sqrt{9} \sqrt{-1} \\ &= -\frac{2}{3}(3)i \\ &= -2i \end{aligned}$$

$$\begin{aligned} 7. \frac{3}{4}\sqrt{-144} &= \frac{3}{4}\sqrt{144} \sqrt{-1} \\ &= \frac{3}{4}(12)i \\ &= 9i \end{aligned}$$

$$\begin{aligned} 8. \frac{1}{3}\sqrt{-25} &= \frac{1}{3}\sqrt{25} \sqrt{-1} \\ &= \frac{1}{3}(5)i \\ &= \frac{5}{3}i \end{aligned}$$

$$\begin{aligned} 9. \sqrt{-\frac{1}{4}} &= \sqrt{\frac{1}{4}} \sqrt{-1} \\ &= \frac{1}{2}i \end{aligned}$$

$$\begin{aligned} 10. \sqrt{-\frac{16}{25}} &= \sqrt{\frac{16}{25}} \sqrt{-1} \\ &= \frac{4}{5}i \end{aligned}$$

$$\begin{aligned} 11. 4\sqrt{-\frac{49}{64}} &= 4\sqrt{\frac{49}{64}} \sqrt{-1} \\ &= \frac{7}{8}i \end{aligned}$$

$$\begin{aligned} 12. \frac{3}{5}\sqrt{-\frac{100}{9}} &= \frac{3}{5}\sqrt{\frac{100}{9}} \sqrt{-1} \\ &= \frac{3}{5}\left(\frac{10}{3}\right)i \\ &= 2i \end{aligned}$$

$$\begin{aligned} 13. \sqrt{-3} &= \sqrt{3} \sqrt{-1} \\ &= i\sqrt{3} \end{aligned}$$

$$\begin{aligned} 14. \sqrt{-29} &= \sqrt{29} \sqrt{-1} \\ &= i\sqrt{29} \end{aligned}$$

$$\begin{aligned} 15. 3\sqrt{-11} &= 3\sqrt{11} \sqrt{-1} \\ &= 3i\sqrt{11} \end{aligned}$$

$$\begin{aligned} 16. -\sqrt{-10} &= -\sqrt{10} \sqrt{-1} \\ &= -i\sqrt{10} \end{aligned}$$

$$\begin{aligned} 17. \sqrt{-20} &= \sqrt{20} \sqrt{-1} \\ &= \sqrt{4} \sqrt{5} \sqrt{-1} \\ &= 2i\sqrt{5} \text{ or } i2\sqrt{5} \end{aligned}$$

$$\begin{aligned} 18. -\sqrt{-28} &= -\sqrt{28} \sqrt{-1} \\ &= -\sqrt{4} \sqrt{7} \sqrt{-1} \\ &= -2i\sqrt{7} \end{aligned}$$

$$\begin{aligned} 19. 2\sqrt{-75} &= 2\sqrt{75} \sqrt{-1} \\ &= 2\sqrt{25} \sqrt{3} \sqrt{-1} \\ &= 2(5)i\sqrt{3} \\ &= 10i\sqrt{3} \end{aligned}$$

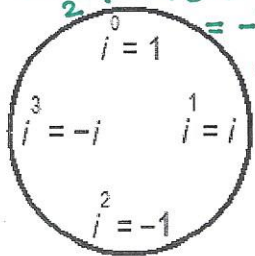
$$\begin{aligned} 20. 5\sqrt{-8} &= 5\sqrt{8} \sqrt{-1} \\ &= 5\sqrt{4} \sqrt{2} \sqrt{-1} \\ &= 5(2)i\sqrt{2} \\ &= 10i\sqrt{2} \end{aligned}$$

$$\begin{aligned} 21. \frac{2}{3}\sqrt{-72} &= \frac{2}{3}\sqrt{72} \sqrt{-1} \\ &= \frac{2}{3}\sqrt{9} \sqrt{8} \sqrt{-1} \\ &= \frac{2}{3}(3)\sqrt{8} i \\ &= \frac{2i\sqrt{8}}{3} \text{ or } i\frac{2\sqrt{8}}{3} \end{aligned}$$

$$\begin{aligned} 22. -\frac{1}{2}\sqrt{-300} &= -\frac{1}{2}\sqrt{300} \sqrt{-1} \\ &= -\frac{1}{2}\sqrt{100} \sqrt{3} \sqrt{-1} \\ &= -\frac{1}{2}(10)\sqrt{3} i \\ &= -5i\sqrt{3} \end{aligned}$$

$$\begin{aligned} 23. -\sqrt{-\frac{1}{3}} &= -\sqrt{\frac{1}{3}} \sqrt{-1} \\ &= -i\sqrt{\frac{1}{3}} \\ &= -i \frac{\sqrt{1}}{\sqrt{3}} \cdot \frac{\sqrt{3}}{\sqrt{3}} \\ &= -\frac{i\sqrt{3}}{3} \end{aligned}$$

$$\begin{aligned} 24. 4\sqrt{-\frac{1}{8}} &= 4\sqrt{\frac{1}{8}} \sqrt{-1} \\ &= 4\sqrt{\frac{1}{4}} \sqrt{\frac{1}{2}} \sqrt{-1} \\ &= 4\left(\frac{1}{2}\right)i\sqrt{\frac{1}{2}} \\ &= 2i\sqrt{\frac{1}{2}} \\ &= 2i \frac{\sqrt{1}}{\sqrt{2}} \cdot \frac{\sqrt{2}}{\sqrt{2}} \\ &= i\sqrt{2} \end{aligned}$$

Simplify powers of i Write each given power of i in simplest terms as 1, i , -1 , or $-i$. Show how you arrived at your answer.

$$25. i^{12} = i^{\textcircled{12}} = 1$$

6 pairs of i^2 , so its positive 1

$$26. i^7 = i^6 \cdot i = (-1)i \text{ or } -i$$

3 pairs of i^2 , so its negative 1

$$27. i^{49} = i^{48} \cdot i = 1i \text{ or } i$$

24 pairs, so its positive 1

$$28. i^{72} = 1$$

36 pairs, even
so, it's positive 1

$$29. i^{54} = -1$$

27 pairs, odd,
so, it's negative 1

$$30. i^{99} = i^{98} i = -i \text{ or } -i$$

49 pairs, odd,
so, it's negative 1

$$31. i^{300} = 1$$

150 pairs, even
so, it's positive 1

$$32. i^{246} = -1$$

123 pairs, odd
so, it's negative 1

$$33. i^{91} = i^{90} i$$

45 pairs, odd
so, it's negative

$$34. i^8 + i^9 + i^{10} = 1 + i - 1 = i$$

You can not add
terms with different
powers.

$$i^8 = 1$$

$$i^9 = i^8 \cdot i$$

$$= 1i \text{ or } i$$

$$i^{10} = -1$$

$$35. i^8 \cdot i^9 \cdot i^{10} = i^{8+9+10}$$

$$= i^{27}$$

$$= i^{26} i = -i \text{ or } -i$$

13 pairs, odd
so, it's negative 1

$$36.) \quad 2i^2 \cdot (3i)^3 = 2i^2 \cdot 3^3 i^3$$

$$= 2 \cdot 3^3 \cdot i^2 \cdot i^3$$

$$= 2 \cdot 27 \cdot i^{2+3}$$

$$= 54 i^5 \rightarrow i^4 \cdot i$$

$$= 54(1)i$$

$$\text{or } \underline{54i}$$

2 pairs, even
so, it's positive 1

$$\begin{aligned}
 37. \sqrt{-64} + \sqrt{-36} &= i\sqrt{64} + i\sqrt{36} \\
 &= i8 + i6 \\
 &= \underline{i14} \text{ or } \underline{14i}
 \end{aligned}$$

$$\begin{aligned}
 38. 3\sqrt{-4} + \sqrt{-121} &= 3i\sqrt{4} + i\sqrt{121} \\
 &= 3i(2) + i(11) \\
 &= 6i + 11i \\
 &= \underline{17i} \text{ or } \underline{i17}
 \end{aligned}$$

$$\begin{aligned}
 39. \sqrt{-100} - \sqrt{-9} &= i\sqrt{100} - i\sqrt{9} \\
 &= i10 - i9 \\
 &= \underline{i} \text{ or } \underline{i}
 \end{aligned}$$

$$\begin{aligned}
 40. \sqrt{-16} - 2\sqrt{-4} &= i\sqrt{16} - 2i\sqrt{4} \\
 &= i(4) - 2i(2) \\
 &= i4 - 4i \\
 &= \underline{0}
 \end{aligned}$$

$$\begin{aligned}
 41. \sqrt{-49} \cdot \sqrt{-1} &= \sqrt{-49 \cdot -1} \\
 &= \sqrt{49} \\
 &= 7
 \end{aligned}$$

$$\begin{aligned}
 42. \sqrt{-81} \cdot \sqrt{-25} &= i\sqrt{81} \cdot i\sqrt{25} \\
 &= i9 \cdot i5 \\
 &= 45i^2 \\
 &= 45(-1) \\
 &= \underline{-45}
 \end{aligned}$$

many ways to do this. you can multiply directly

$$\begin{aligned}
 43. \sqrt{-2} \cdot \sqrt{-18} &= \sqrt{(-2)(-18)} \\
 &= \sqrt{36} \text{ or } 6
 \end{aligned}$$

or you can use "i"

$$\begin{aligned}
 44. -4\sqrt{-3} \cdot \sqrt{-3} &= -4i\sqrt{3} \cdot i\sqrt{3} \\
 &= -4i^2(3) \\
 &= -4(-1)(3) \\
 &= 12
 \end{aligned}$$

or you can use "i".

$$\begin{aligned}
 45. -3\sqrt{-10} \cdot 2\sqrt{-10} &= \\
 &\text{multiply directly} \\
 &= (-3)(2)(\sqrt{-10 \cdot -10}) \\
 &= (-3)(2)(\sqrt{100}) \\
 &= (-3)(2)(10) \\
 &= \underline{-60}
 \end{aligned}$$

$$\begin{aligned}
 46. \frac{2}{3}\sqrt{-7} \cdot \sqrt{-63} &= \frac{2}{3}i\sqrt{7} \cdot i\sqrt{63} \\
 &\text{lets use "i"} \\
 &= \frac{2}{3}i^2\sqrt{7} \cdot \sqrt{9}\sqrt{7} \\
 &= \frac{2}{3}i^2(3)(\sqrt{7})^2 \\
 &= \frac{2}{3}(-1)(3)(7) \\
 &= \underline{-14}
 \end{aligned}$$