

1. Compute the following limit: $\lim_{x \rightarrow -1} \frac{x^3 + 1}{x^2 - 1}$

2. Compute the following limit: $\lim_{x \rightarrow 2} \frac{x^3 - 8}{x^2 - 4}$

3. Compute the following limit: $\lim_{x \rightarrow 4} \frac{x^3 - 64}{x^2 - 16}$

4. Compute the following limit: $\lim_{x \rightarrow -4} \frac{x^3 + 64}{x^2 - 16}$

5. Compute the following limit: $\lim_{x \rightarrow -3} \frac{x^3 + 27}{x^2 - 9}$

6. Compute the following limit: $\lim_{x \rightarrow 1} \frac{x^3 - 1}{x^2 - 1}$

7. Compute the following limit: $\lim_{x \rightarrow -2} \frac{x^3 + 8}{x^2 - 4}$

8. Compute the following limit: $\lim_{x \rightarrow -5} \frac{x^3 + 125}{x^2 - 25}$

9. Compute the following limit: $\lim_{x \rightarrow 3} \frac{x^3 - 27}{x^2 - 9}$

10. Compute the following limit: $\lim_{x \rightarrow 5} \frac{x^3 - 125}{x^2 - 25}$

Answers: 1. $\frac{2}{3}$ 2. 3 3. 3 4. -6 5. $\frac{2}{9}$ 6. $\frac{2}{3}$ 7. -3 8. $\frac{2}{-15}$ 9. $\frac{2}{9}$ 10. $\frac{2}{15}$

Solutions:

$$\begin{aligned}
1. \quad & \lim_{x \rightarrow -1} \frac{x^3 + 1}{x^2 - 1} \quad \blacktriangleright \text{ Use: } (a + b)^3 = (a + b)(a^2 - ab + b^2) \quad \text{or} \quad (a - b)^3 = (a - b)(a^2 + ab + b^2) \\
& = \lim_{x \rightarrow -1} \frac{(x + 1)(x^2 - x + 1)}{(x + 1)(x - 1)} \quad \blacktriangleright \text{ Simplify the common factor:} \\
& = \lim_{x \rightarrow -1} \frac{x^2 - x + 1}{x - 1} \quad \blacktriangleright \text{ Use substitution to compute the limit:} \\
& = \frac{1 - 1(-1) + 1}{-1 - 1} \quad \blacktriangleright \text{ Simplify:} \\
& = \frac{-3}{2}
\end{aligned}$$

$$\begin{aligned}
2. \quad & \lim_{x \rightarrow 2} \frac{x^3 - 8}{x^2 - 4} \quad \blacktriangleright \text{ Use: } (a + b)^3 = (a + b)(a^2 - ab + b^2) \quad \text{or} \quad (a - b)^3 = (a - b)(a^2 + ab + b^2) \\
& = \lim_{x \rightarrow 2} \frac{(x - 2)(x^2 + 2x + 4)}{(x - 2)(x + 2)} \quad \blacktriangleright \text{ Simplify the common factor:} \\
& = \lim_{x \rightarrow 2} \frac{x^2 + 2x + 4}{x + 2} \quad \blacktriangleright \text{ Use substitution to compute the limit:} \\
& = \frac{4 + 2(2) + 4}{2 + 2} \quad \blacktriangleright \text{ Simplify:} \\
& = 3
\end{aligned}$$

$$\begin{aligned}
3. \quad & \lim_{x \rightarrow 4} \frac{x^3 - 64}{x^2 - 16} \quad \blacktriangleright \text{ Use: } (a + b)^3 = (a + b)(a^2 - ab + b^2) \quad \text{or} \quad (a - b)^3 = (a - b)(a^2 + ab + b^2) \\
& = \lim_{x \rightarrow 4} \frac{(x - 4)(x^2 + 4x + 16)}{(x - 4)(x + 4)} \quad \blacktriangleright \text{ Simplify the common factor:} \\
& = \lim_{x \rightarrow 4} \frac{x^2 + 4x + 16}{x + 4} \quad \blacktriangleright \text{ Use substitution to compute the limit:} \\
& = \frac{16 + 4(4) + 16}{4 + 4} \quad \blacktriangleright \text{ Simplify:} \\
& = 6
\end{aligned}$$

$$\begin{aligned}
4. \quad & \lim_{x \rightarrow -4} \frac{x^3 + 64}{x^2 - 16} \quad \blacktriangleright \text{ Use: } (a + b)^3 = (a + b)(a^2 - ab + b^2) \quad \text{or} \quad (a - b)^3 = (a - b)(a^2 + ab + b^2) \\
& = \lim_{x \rightarrow -4} \frac{(x + 4)(x^2 - 4x + 16)}{(x + 4)(x - 4)} \quad \blacktriangleright \text{ Simplify the common factor:} \\
& = \lim_{x \rightarrow -4} \frac{x^2 - 4x + 16}{x - 4} \quad \blacktriangleright \text{ Use substitution to compute the limit:} \\
& = \frac{16 - 4(-4) + 16}{-4 - 4} \quad \blacktriangleright \text{ Simplify:} \\
& = -6
\end{aligned}$$

$$5. \quad \lim_{x \rightarrow -3} \frac{x^3 + 27}{x^2 - 9} \quad \blacktriangleright \text{ Use: } (a + b)^3 = (a + b)(a^2 - ab + b^2) \quad \text{or} \quad (a - b)^3 = (a - b)(a^2 + ab + b^2)$$

$$= \lim_{x \rightarrow -3} \frac{(x+3)(x^2-3x+9)}{(x+3)(x-3)} \quad \blacktriangleright \text{Simplify the common factor:}$$

$$= \lim_{x \rightarrow -3} \frac{x^2-3x+9}{x-3} \quad \blacktriangleright \text{Use substitution to compute the limit:}$$

$$= \frac{9-3(-3)+9}{-3-3} \quad \blacktriangleright \text{Simplify:}$$

$$= \frac{-9}{2}$$

$$6. \lim_{x \rightarrow 1} \frac{x^3-1}{x^2-1} \quad \blacktriangleright \text{Use: } (a+b)^3 = (a+b)(a^2-ab+b^2) \quad \text{or} \quad (a-b)^3 = (a-b)(a^2+ab+b^2)$$

$$= \lim_{x \rightarrow 1} \frac{(x-1)(x^2+x+1)}{(x-1)(x+1)} \quad \blacktriangleright \text{Simplify the common factor:}$$

$$= \lim_{x \rightarrow 1} \frac{x^2+x+1}{x+1} \quad \blacktriangleright \text{Use substitution to compute the limit:}$$

$$= \frac{1+1(1)+1}{1+1} \quad \blacktriangleright \text{Simplify:}$$

$$= \frac{3}{2}$$

$$7. \lim_{x \rightarrow -2} \frac{x^3+8}{x^2-4} \quad \blacktriangleright \text{Use: } (a+b)^3 = (a+b)(a^2-ab+b^2) \quad \text{or} \quad (a-b)^3 = (a-b)(a^2+ab+b^2)$$

$$= \lim_{x \rightarrow -2} \frac{(x+2)(x^2-2x+4)}{(x+2)(x-2)} \quad \blacktriangleright \text{Simplify the common factor:}$$

$$= \lim_{x \rightarrow -2} \frac{x^2-2x+4}{x-2} \quad \blacktriangleright \text{Use substitution to compute the limit:}$$

$$= \frac{4-2(-2)+4}{-2-2} \quad \blacktriangleright \text{Simplify:}$$

$$= -3$$

$$8. \lim_{x \rightarrow -5} \frac{x^3+125}{x^2-25} \quad \blacktriangleright \text{Use: } (a+b)^3 = (a+b)(a^2-ab+b^2) \quad \text{or} \quad (a-b)^3 = (a-b)(a^2+ab+b^2)$$

$$= \lim_{x \rightarrow -5} \frac{(x+5)(x^2-5x+25)}{(x+5)(x-5)} \quad \blacktriangleright \text{Simplify the common factor:}$$

$$= \lim_{x \rightarrow -5} \frac{x^2-5x+25}{x-5} \quad \blacktriangleright \text{Use substitution to compute the limit:}$$

$$= \frac{25-5(-5)+25}{-5-5} \quad \blacktriangleright \text{Simplify:}$$

$$= \frac{-15}{2}$$

$$9. \lim_{x \rightarrow 3} \frac{x^3-27}{x^2-9} \quad \blacktriangleright \text{Use: } (a+b)^3 = (a+b)(a^2-ab+b^2) \quad \text{or} \quad (a-b)^3 = (a-b)(a^2+ab+b^2)$$

$$= \lim_{x \rightarrow 3} \frac{(x-3)(x^2+3x+9)}{(x-3)(x+3)} \quad \blacktriangleright \text{Simplify the common factor:}$$

$$= \lim_{x \rightarrow 3} \frac{x^2+3x+9}{x+3} \quad \blacktriangleright \text{Use substitution to compute the limit:}$$

$$= \frac{9 + 3(3) + 9}{3 + 3} \quad \blacktriangleright \text{Simplify:}$$

$$= \frac{9}{2}$$

$$10. \lim_{x \rightarrow 5} \frac{x^3 - 125}{x^2 - 25} \quad \blacktriangleright \text{Use: } (a + b)^3 = (a + b)(a^2 - ab + b^2) \quad \text{or} \quad (a - b)^3 = (a - b)(a^2 + ab + b^2)$$

$$= \lim_{x \rightarrow 5} \frac{(x - 5)(x^2 + 5x + 25)}{(x - 5)(x + 5)} \quad \blacktriangleright \text{Simplify the common factor:}$$

$$= \lim_{x \rightarrow 5} \frac{x^2 + 5x + 25}{x + 5} \quad \blacktriangleright \text{Use substitution to compute the limit:}$$

$$= \frac{25 + 5(5) + 25}{5 + 5} \quad \blacktriangleright \text{Simplify:}$$

$$= \frac{15}{2}$$