

# Soal Latihan dan Pembahasan Limit Fungsi

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## Limit Fungsi

1.  $\lim_{x \rightarrow 2} \frac{x^2 - 4}{x^3 + 1} = \dots$

Jawab :

$$\lim_{x \rightarrow 2} \frac{x^2 - 4}{x^3 + 1} = \frac{4 - 4}{8 + 1} = 0$$

2.  $\lim_{x \rightarrow 3} \frac{x^2 + 3x - 18}{x^2 - 3x} = \dots$

Jawab :

$$\lim_{x \rightarrow 3} \frac{(x + 6)(x - 3)}{x(x - 3)} = \frac{3 + 6}{3} = 3$$

3.  $\lim_{t \rightarrow 4} \frac{\sqrt{t} - 2}{t - 4} = \dots$

Jawab :

$$\lim_{t \rightarrow 4} \frac{\sqrt{t} - 2}{(\sqrt{t} - 2)(\sqrt{t} + 2)} = \frac{1}{2 + 2} = \frac{1}{4}$$

4.  $\lim_{x \rightarrow 3} \frac{9 - x^2}{4 - \sqrt{x^2 + 7}} = \dots$

Jawab :

$$\lim_{x \rightarrow 3} \frac{16 - (x^2 + 7)}{4 - \sqrt{x^2 + 7}} = \lim_{x \rightarrow 3} \frac{(4 - \sqrt{x^2 + 7})(4 + \sqrt{x^2 + 7})}{4 - \sqrt{x^2 + 7}} = 4 + 4 = 8$$

5.  $\lim_{x \rightarrow \infty} \frac{x^2 - 4}{x^3 + 1} = \dots$

Jawab :

$$\lim_{x \rightarrow \infty} \frac{x^2}{x^3} = \lim_{x \rightarrow \infty} \frac{1}{x} = 0$$

$$6. \quad \lim_{x \rightarrow \infty} \frac{(4+5x)(2-x)}{(2+x)(1-x)} = \dots$$

**Jawab :**

$$\lim_{x \rightarrow \infty} \frac{-5x^2}{-x^2} = 5$$

$$7. \quad \lim_{x \rightarrow \infty} \sqrt{x^2 + x + 5} - \sqrt{x^2 - 2x + 3} = \dots$$

**Jawab :**

$$\lim_{x \rightarrow \infty} \sqrt{ax^2 + bx + c} - \sqrt{ax^2 + px + q} = \frac{b-p}{2\sqrt{a}}$$

$$\lim_{x \rightarrow \infty} \sqrt{x^2 + x + 5} - \sqrt{x^2 - 2x + 3} = \frac{1+2}{2\sqrt{1}} = \frac{3}{2}$$

$$8. \quad \lim_{x \rightarrow \frac{\pi}{2}} \frac{1 - \sin^2 x}{(\sin \frac{1}{2}x - \cos \frac{1}{2}x)^2} = \dots$$

**Jawab :**

$$\lim_{x \rightarrow \frac{\pi}{2}} \frac{(1 - \sin x)(1 + \sin x)}{\sin^2 \frac{1}{2}x + \cos^2 \frac{1}{2}x - 2\sin \frac{1}{2}x \cos \frac{1}{2}x} = \lim_{x \rightarrow \frac{\pi}{2}} \frac{(1 - \sin x)(1 + \sin x)}{1 - \sin x} = 1 + 1 = 2$$

$$9. \quad \lim_{x \rightarrow 0} \frac{\sin 6x}{\sin 2x} = \dots$$

**Jawab :**

$$\lim_{x \rightarrow 0} \frac{\sin 6x}{\sin 2x} = \frac{6}{2} = 3$$

$$10. \quad \lim_{x \rightarrow 0} \frac{\cos 2x - 1}{x^2} = \dots$$

**Jawab :**

$$\lim_{x \rightarrow 0} \frac{1 - 2\sin^2 x - 1}{x^2} = \lim_{x \rightarrow 0} -2 \cdot \frac{\sin x}{x} \cdot \frac{\sin x}{x} = -2 \cdot 1 \cdot 1 = -2$$

$$11. \lim_{x \rightarrow 2} \frac{\sin(x-2)}{x^2-4} = \dots\dots$$

Jawab :

$$\lim_{x \rightarrow 2} \frac{\sin(x-2)}{(x-2)(x+2)} = \lim_{x \rightarrow 2} \frac{\sin(x-2)}{x-2} \cdot \frac{1}{x+2} = 1 \cdot \frac{1}{2+2} = \frac{1}{4}$$

$$12. \lim_{x \rightarrow 3} \frac{x^2+x-6}{x^2+5x+6} = \dots\dots$$

Jawab :

$$\lim_{x \rightarrow 3} \frac{x^2+x-6}{x^2+5x+6} = \frac{9+3-6}{9+15+6} = \frac{1}{5}$$

$$13. \lim_{x \rightarrow 1} \frac{2x^2-x-1}{3x^2-x-2} = \dots\dots$$

Jawab :

$$\lim_{x \rightarrow 1} \frac{4x-1}{6x-1} = \frac{3}{5} \quad (\text{Menggunakan bantuan turunan})$$

$$14. \lim_{x \rightarrow 1} \frac{1-x^2}{x-1} = \dots\dots$$

Jawab :

$$\lim_{x \rightarrow 1} \frac{-2x}{1} = -2$$

$$15. \lim_{x \rightarrow 1} \frac{2x^2-2}{x-1} = \dots\dots$$

Jawab :

$$\lim_{x \rightarrow 1} \frac{4x}{1} = 4$$

$$16. \lim_{t \rightarrow 2} \frac{t^3 - 8}{t^2 + t - 6} = \dots\dots$$

Jawab :

$$\lim_{t \rightarrow 2} \frac{3t^2}{2t+1} = \frac{12}{5}$$

$$17. \lim_{x \rightarrow 1} \frac{(3x-1)^2 - 4}{x^2 + 4x - 5} = \dots\dots$$

Jawab :

$$\lim_{x \rightarrow 1} \frac{18x - 6}{2x + 4} = \frac{12}{6} = 2$$

$$18. \lim_{x \rightarrow 2} \left( \frac{2x^2 - 8}{x - 2} + \frac{x^2 - 2x}{2x - 4} \right) = \dots\dots$$

Jawab :

$$\lim_{x \rightarrow 2} \left( \frac{(x-2)(2x+4)}{x-2} + \frac{x(x-2)}{2(x-2)} \right) = 4 + 4 + \frac{2}{2} = 9$$

$$19. \lim_{x \rightarrow 2} \left( \frac{6-x}{x^2-4} - \frac{1}{x-2} \right) = \dots\dots$$

Jawab :

$$\lim_{x \rightarrow 2} \frac{-2(x-2)}{(x-2)(x+2)} = \frac{-2}{4} = -\frac{1}{2}$$

$$20. \lim_{x \rightarrow 0} \frac{6x^2 - 4x}{2x^2 + x} = \dots\dots$$

Jawab :

$$\lim_{x \rightarrow 0} \frac{12x - 4}{4x + 1} = \frac{-4}{1} = -4$$

$$21. \lim_{x \rightarrow 1} \frac{x-1}{1-\sqrt{x}} = \dots\dots$$

**Jawab :**

$$\lim_{x \rightarrow 1} \frac{1}{-\frac{1}{2\sqrt{x}}} = -\frac{1}{\frac{1}{2}} = -2$$

$$22. \lim_{x \rightarrow 4} \frac{x^2 - 16}{\sqrt{x} - 4} = \dots\dots$$

**Jawab :**

$$\lim_{x \rightarrow 4} \frac{(\sqrt{x-4})^2(x+4)}{\sqrt{x-4}} = \lim_{x \rightarrow 4} \sqrt{x-4}(x+4) = 0 \cdot 8 = 0$$

$$23. \lim_{x \rightarrow 0} \frac{3 - \sqrt{2x+9}}{x} = \dots\dots$$

**Jawab :**

$$\lim_{x \rightarrow 0} \frac{3 - \sqrt{2x+9}}{x} \cdot \frac{3 + \sqrt{2x+9}}{3 + \sqrt{2x+9}} = \lim_{x \rightarrow 0} \frac{9 - 2x - 9}{x(3 + \sqrt{2x+9})} = \frac{-2}{3+3} = -\frac{1}{3}$$

$$24. \lim_{x \rightarrow 3} \frac{x^2 - 9}{\sqrt{x^2 + 16} - 5} = \dots\dots$$

**Jawab :**

$$\lim_{x \rightarrow 3} \frac{(\sqrt{x^2 + 16} - 5)(\sqrt{x^2 + 16} + 5)}{\sqrt{x^2 + 16} - 5} = 5 + 5 = 10$$

$$25. \lim_{x \rightarrow 0} \frac{\sqrt{x} - x}{\sqrt{x} + x} = \dots\dots$$

**Jawab :**

$$\lim_{x \rightarrow 0} \frac{\sqrt{x}(1 - \sqrt{x})}{\sqrt{x}(1 + \sqrt{x})} = \frac{1 - 0}{1 + 0} = 1$$

$$26. \lim_{x \rightarrow 3} \frac{\sqrt{6x-2} - \sqrt{3x+7}}{x-3} = \dots\dots$$

Jawab :

$$\begin{aligned} \lim_{x \rightarrow 3} \frac{\sqrt{6x-2} - \sqrt{3x+7}}{x-3} &= \frac{\sqrt{6x-2} - \sqrt{3x+7}}{x-3} \cdot \frac{\sqrt{6x-2} + \sqrt{3x+7}}{\sqrt{6x-2} + \sqrt{3x+7}} \\ &= \lim_{x \rightarrow 3} \frac{3(x-3)}{(x-3)(\sqrt{6x-2} + \sqrt{3x+7})} = \frac{3}{8} \end{aligned}$$

$$27. \lim_{x \rightarrow 0} \frac{2x^2 - 5x}{3 - \sqrt{9+x}} = \dots\dots$$

Jawab :

$$\lim_{x \rightarrow 0} \frac{2x^2 - 5x}{3 - \sqrt{9+x}} \cdot \frac{3 + \sqrt{9+x}}{3 + \sqrt{9+x}} = \frac{x(2x-5)(3 + \sqrt{9+x})}{-x} = \frac{-5(3+3)}{-1} = 30$$

$$28. \lim_{x \rightarrow 1} \frac{\sqrt{x^2+3} - x - 1}{1-x^2} = \dots\dots$$

Jawab :

$$\lim_{x \rightarrow 1} \frac{\sqrt{x^2+3} - (x+1)}{1-x^2} \cdot \frac{\sqrt{x^2+3} + (x+1)}{\sqrt{x^2+3} + (x+1)} = \lim_{x \rightarrow 1} \frac{2(1-x)}{(1-x)(1+x)(\sqrt{x^2+3} + x+1)} = \frac{1}{4}$$

$$29. \lim_{x \rightarrow 1} \frac{\sqrt[3]{x^2} - 2\sqrt[3]{x} + 1}{(x-1)^2} = \dots\dots$$

Jawab :

$$\lim_{x \rightarrow 1} \frac{(\sqrt[3]{x} - 1)^2}{(\sqrt[3]{x} - 1)(\sqrt[3]{x^2} + \sqrt[3]{x} + 1)^2} = \frac{1}{(1+1+1)^2} = \frac{1}{9}$$

$$30. \lim_{x \rightarrow 27} \frac{x-27}{\sqrt[3]{x}-3} = \dots\dots$$

Jawab :

$$\lim_{x \rightarrow 27} \frac{(\sqrt[3]{x}-3)(\sqrt[3]{x^2} + 3\sqrt[3]{x} + 9)}{\sqrt[3]{x}-3} = 9 + 9 + 9 = 27$$

$$31. \lim_{a \rightarrow b} \frac{a\sqrt{a} - b\sqrt{b}}{\sqrt{a} - \sqrt{b}} = \dots\dots$$

Jawab :

$$\lim_{a \rightarrow b} \frac{(\sqrt{a} - \sqrt{b})(a + \sqrt{ab} + b)}{\sqrt{a} - \sqrt{b}} = b + \sqrt{b \cdot b} + b = 3b$$

$$32. \text{ Jika } \lim_{x \rightarrow 4} \frac{ax + b - \sqrt{x}}{x - 4} = \frac{3}{4} \text{ maka tentukan } a + b$$

Jawab :

Bentuk di atas jika  $x = 4$  maka harus berbentuk  $\frac{0}{0}$ .

$$\text{Jadi } 4a + b - 2 = 0 \text{ atau } 4a + b = 2 \dots\dots\dots (1)$$

Dengan menggunakan bantuan turunan maka :

$$\lim_{x \rightarrow 4} \frac{a - \frac{1}{2\sqrt{x}}}{1} = \frac{3}{4} \Rightarrow a - \frac{1}{4} = \frac{3}{4} \Leftrightarrow a = 1$$

$$4 \cdot 1 + b = 2 \Leftrightarrow b = -2$$

$$a + b = 1 - 2 = -1$$

$$33. \lim_{x \rightarrow 1} \frac{(2x - 3\sqrt{x} + 1)(\sqrt{x} - 1)}{(x - 1)^2} = \dots\dots$$

Jawab :

$$\lim_{x \rightarrow 1} \frac{(\sqrt{x} - 1)^2(2\sqrt{x} - 1)}{(\sqrt{x} - 1)^2(\sqrt{x} + 1)} = \frac{2 - 1}{(1 + 1)^2} = \frac{1}{4}$$

$$34. \lim_{x \rightarrow 0} \frac{\sqrt{1+x} - 1}{\sqrt[3]{1+x} - 1} = \dots\dots$$

Jawab :

$$\lim_{x \rightarrow 0} \frac{(\sqrt[6]{1+x} - 1)(\sqrt[6]{(1+x)^2} + \sqrt[6]{1+x} + 1)}{(\sqrt[6]{1+x} - 1)(\sqrt[6]{1+x} + 1)} = \frac{1 + 1 + 1}{1 + 1} = \frac{3}{2}$$

$$35. \lim_{x \rightarrow 0} \frac{\sqrt{2+\sqrt{x}} - \sqrt{2-\sqrt{x}}}{\sqrt{x}} = \dots\dots$$

**Jawab :**

$$\begin{aligned} & \lim_{x \rightarrow 0} \frac{\sqrt{2+\sqrt{x}} - \sqrt{2-\sqrt{x}}}{\sqrt{x}} \cdot \frac{\sqrt{2+\sqrt{x}} + \sqrt{2-\sqrt{x}}}{\sqrt{2+\sqrt{x}} + \sqrt{2-\sqrt{x}}} \\ &= \lim_{x \rightarrow 0} \frac{2\sqrt{x}}{\sqrt{x}(\sqrt{2+\sqrt{x}} + \sqrt{2-\sqrt{x}})} = \frac{2}{\sqrt{2} + \sqrt{2}} = \frac{1}{2}\sqrt{2} \end{aligned}$$

$$36. \lim_{x \rightarrow 2} \left( \frac{2}{x^2 - 4} - \frac{3}{x^2 + 2x - 8} \right) = \dots\dots$$

**Jawab :**

$$\lim_{x \rightarrow 2} \frac{2(x+4) - 3(x+2)}{(x-2)(x+2)(x+4)} = \lim_{x \rightarrow 2} \frac{-(x-2)}{(x-2)(x+2)(x+4)} = -\frac{1}{24}$$

$$37. \lim_{x \rightarrow \infty} \sqrt{(2x-5)(2x+1)} - (2x-5) = \dots\dots$$

**Jawab :**

$$\lim_{x \rightarrow \infty} \sqrt{4x^2 - 8x - 5} - \sqrt{4x^2 - 20x + 25} = \frac{-8 - (-20)}{2\sqrt{4}} = 3$$

$$38. \lim_{x \rightarrow \infty} \frac{2x^2 + 3x}{\sqrt{x^2 - x}} = \dots\dots$$

**Jawab :**

$$\lim_{x \rightarrow \infty} \frac{2x^2}{\sqrt{x^2}} = \lim_{x \rightarrow \infty} 2x = \infty$$

$$39. \lim_{x \rightarrow 5} \sqrt{x(4x+5)} - \sqrt{4x^2+3} = \dots\dots$$

**Jawab :**

$$\lim_{x \rightarrow 5} \sqrt{4x^2 + 5x} - \sqrt{4x^2 + 0x + 3} = \frac{5 - 0}{2\sqrt{4}} = \frac{5}{4}$$

$$40. \lim_{x \rightarrow \infty} \sqrt{(x+a)(x+b)} - x = \dots\dots$$

**Jawab :**

$$\lim_{x \rightarrow \infty} \sqrt{x^2 + (a+b)x + ab} - \sqrt{x^2 + 0x} = \frac{a+b-0}{2\sqrt{1}} = \frac{a+b}{2}$$

$$41. \lim_{x \rightarrow \frac{\pi}{4}} \frac{\cos 2x}{\sin x - \cos x} = \dots\dots$$

**Jawab :**

$$\lim_{x \rightarrow \frac{\pi}{4}} \frac{(\cos x - \sin x)(\cos x + \sin x)}{-(\cos x - \sin x)} = \frac{\frac{1}{2}\sqrt{2} + \frac{1}{2}\sqrt{2}}{-1} = -\sqrt{2}$$

$$42. \lim_{x \rightarrow 0} \frac{\sin ax}{\sin bx} = \dots\dots$$

**Jawab :**

$$\lim_{x \rightarrow 0} \frac{\sin ax}{\sin bx} \cdot \frac{bx}{ax} \cdot \frac{a}{b} = \lim_{x \rightarrow 0} \frac{\sin ax}{ax} \cdot \frac{bx}{\sin bx} \cdot \frac{a}{b} = 1 \cdot 1 \cdot \frac{a}{b} = \frac{a}{b}$$

$$43. \lim_{x \rightarrow 0} \frac{\sin 2x}{3 - \sqrt{2x+9}} = \dots\dots$$

**Jawab :**

$$\begin{aligned} & \lim_{x \rightarrow 0} \frac{2 \sin x \cos x}{3 - \sqrt{2x+9}} \cdot \frac{3 + \sqrt{2x+9}}{3 + \sqrt{2x+9}} \\ &= \lim_{x \rightarrow 0} \frac{\sin x}{x} \cdot \frac{\cos x \cdot (3 + \sqrt{2x+9})}{-1} = 1 \cdot \frac{1 \cdot (3+3)}{-1} = -6 \end{aligned}$$

$$44. \lim_{x \rightarrow 0} \frac{1 - \cos x}{x \sin 2x} = \dots\dots$$

**Jawab :**

$$\lim_{x \rightarrow 0} \frac{2 \sin^2 \frac{1}{2}x}{x \sin 2x} = \lim_{x \rightarrow 0} \frac{\sin \frac{1}{2}x}{\frac{1}{2}x} \cdot \frac{\sin \frac{1}{2}x}{\sin 2x} = 1 \cdot \frac{\frac{1}{2}}{2} = \frac{1}{4}$$

$$45. \lim_{x \rightarrow 0} \frac{x \tan x}{1 - \cos 2x} = \dots\dots$$

**Jawab :**

$$\lim_{x \rightarrow 0} \frac{x \tan x}{2 \sin^2 x} = \lim_{x \rightarrow 0} \frac{1}{2} \cdot \frac{x}{\sin x} \cdot \frac{\tan x}{\sin x} = \frac{1}{2}$$

$$46. \lim_{x \rightarrow 0} \frac{\tan x}{x^2 + 2x} = \dots\dots$$

**Jawab :**

$$\lim_{x \rightarrow 0} \frac{\tan x}{x} \cdot \frac{1}{x+2} = 1 \cdot \frac{1}{2} = \frac{1}{2}$$

$$47. \lim_{x \rightarrow 0} \frac{1 - \cos x}{5x^2} = \dots\dots$$

**Jawab :**

$$\lim_{x \rightarrow 0} \frac{2 \sin^2 \frac{1}{2}x}{5x^2} = \frac{2}{5} \cdot \frac{1}{2} \cdot \frac{1}{2} = \frac{1}{10}$$

$$48. \lim_{x \rightarrow 0} \frac{\sin x}{\sqrt{1-x}-1} = \dots\dots$$

**Jawab :**

$$\lim_{x \rightarrow 0} \frac{\sin x}{\sqrt{1-x}-1} \cdot \frac{\sqrt{1-x}+1}{\sqrt{1-x}+1} = \lim_{x \rightarrow 0} \frac{\sin x}{x} \cdot \frac{\sqrt{1-x}+1}{-1} = 1 \cdot \frac{1+1}{-1} = -2$$

$$49. \lim_{x \rightarrow 0} \frac{\cot x}{\cot 2x} = \dots\dots$$

**Jawab :**

$$\lim_{x \rightarrow 0} \frac{\frac{1}{\tan x}}{\frac{1}{\tan 2x}} = \lim_{x \rightarrow 0} \frac{\tan 2x}{\tan x} = 2$$

$$50. \lim_{x \rightarrow 0} \frac{\sin 4x + \sin 2x}{3x \cos x} = \dots\dots$$

Jawab :

$$\lim_{x \rightarrow 0} \frac{2 \sin 3x \cos x}{3x \cos x} = 2 \cdot 1 = 2$$

$$51. \lim_{x \rightarrow 0} \frac{x \sin x}{1 - \cos 4x} = \dots\dots$$

Jawab :

$$\lim_{x \rightarrow 0} \frac{x \sin x}{2 \sin^2 2x} = \lim_{x \rightarrow 0} \frac{1}{2} \cdot \frac{x}{\sin 2x} \cdot \frac{\sin x}{\sin 2x} = \frac{1}{2} \cdot \frac{1}{2} \cdot \frac{1}{2} = \frac{1}{8}$$

$$52. \lim_{x \rightarrow 0} \frac{\cos 4x - 1}{x \tan 2x} = \dots\dots$$

Jawab :

$$\lim_{x \rightarrow 0} \frac{-2 \sin^2 2x}{x \tan 2x} = \lim_{x \rightarrow 0} -2 \cdot \frac{\sin 2x}{x} \cdot \frac{\sin 2x}{\tan 2x} = -2 \cdot \frac{2}{1} \cdot \frac{2}{2} = -4$$

$$53. \lim_{x \rightarrow 0} \frac{\sin^2 2x}{x^2 \cos 2x} = \dots\dots$$

Jawab :

$$\lim_{x \rightarrow 0} \frac{\sin 2x}{x} \cdot \frac{\sin 2x}{x} \cdot \frac{1}{\cos 2x} = \frac{2}{1} \cdot \frac{2}{1} \cdot \frac{1}{1} = 4$$

$$54. \lim_{x \rightarrow 0} \frac{7x^2 + \sin(2x^2)}{\tan^2 3x} = \dots\dots$$

Jawab :

$$\lim_{x \rightarrow 0} \frac{(\sqrt{7}x)^2}{(\tan 3x)^2} + \frac{\sin(\sqrt{2}x)^2}{(\tan 3x)^2} = \frac{7}{9} + \frac{2}{9} = 1$$

$$55. \lim_{x \rightarrow 0} \frac{\cos 4x - 1}{\cos 5x - \cos 3x} = \dots\dots\dots$$

**Jawab :**

$$\lim_{x \rightarrow 0} \frac{-2\sin^2 2x}{-2\sin 4x \sin x} = \lim_{x \rightarrow 0} \frac{\sin 2x}{\sin 4x} \cdot \frac{\sin 2x}{\sin x} = \frac{2}{4} \cdot \frac{2}{1} = 1$$

$$56. \lim_{x \rightarrow 0} \frac{4x}{x + \sin 3x} = \dots\dots\dots$$

**Jawab :**

$$\lim_{x \rightarrow 0} \frac{1}{\frac{x + \sin 3x}{4x}} = \lim_{x \rightarrow 0} \frac{1}{\frac{1}{4} + \frac{\sin 3x}{4x}} = \frac{1}{\frac{1}{4} + \frac{3}{4}} = 1$$

$$57. \lim_{x \rightarrow 0} \frac{\sin(2x^2)}{x^2 + \sin^2 3x} = \dots\dots\dots$$

**Jawab :**

$$\lim_{x \rightarrow 0} \frac{1}{\frac{x^2}{\sin 2x^2} + \frac{\sin^2 3x}{\sin(\sqrt{2}x)^2}} = \frac{1}{\frac{1}{2} + \frac{9}{2}} = \frac{1}{5}$$

$$58. \lim_{x \rightarrow 0} \frac{\sin 4x \cdot \tan^2 3x + 6x^3}{2x^2 \cdot \sin 3x \cdot \cos 2x} = \dots\dots\dots$$

**Jawab :**

$$\begin{aligned} \lim_{x \rightarrow 0} \frac{\sin 4x}{\sin 3x} \cdot \frac{\tan^2 3x}{(\sqrt{2}x)^2} \cdot \frac{1}{\cos 2x} + \frac{6}{2} \cdot \frac{x^2}{x^2} \cdot \frac{x}{\sin 3x} \cdot \frac{1}{\cos 2x} \\ = \frac{4}{3} \cdot \frac{9}{2} \cdot 1 + 3 \cdot 1 \cdot \frac{1}{3} \cdot 1 = 7 \end{aligned}$$

$$59. \lim_{x \rightarrow 0} \frac{1 - \cos^2 x - \cos x \sin^2 x}{x^4} = \dots\dots\dots$$

**Jawab :**

$$\lim_{x \rightarrow 0} \frac{\sin^2 x (1 - \cos x)}{x^4} = \lim_{x \rightarrow 0} 2 \cdot \frac{\sin^2 x}{x^2} \cdot \frac{\sin^2 \frac{1}{2} x}{x^2} = 2 \cdot 1^2 \cdot \left(\frac{1}{2}\right)^2 = \frac{1}{2}$$

$$60. \lim_{x \rightarrow 1} \frac{\sin(1 - \frac{1}{x}) \cos(1 - \frac{1}{x})}{x - 1} = \dots\dots\dots$$

**Jawab :**

$$\lim_{x \rightarrow 1} \frac{\sin(1 - \frac{1}{x}) \cos(1 - \frac{1}{x})}{x(1 - \frac{1}{x})} = \lim_{x \rightarrow 1} \frac{\sin(1 - \frac{1}{x})}{1 - \frac{1}{x}} \cdot \frac{\cos(1 - \frac{1}{x})}{x} = 1 \cdot 1 = 1$$

$$61. \lim_{x \rightarrow 1} \frac{\sin(\pi x - \pi)}{(x - 1) \cos(\pi x - \pi)} = \dots\dots\dots$$

**Jawab :**

$$\lim_{x \rightarrow 1} \frac{\sin \pi (x - 1)}{x - 1} \cdot \frac{1}{\cos(\pi x - \pi)} = \pi \cdot 1 = \pi$$

$$62. \lim_{x \rightarrow k} \frac{x - k}{\sin(x - k) + 2k - 2x} = \dots\dots\dots$$

**Jawab :**

$$\lim_{x \rightarrow k} \frac{1}{\frac{\sin(x - k)}{x - k} - \frac{2(x - k)}{x - k}} = \frac{1}{1 - 2} = -1$$

$$63. \lim_{x \rightarrow 2} \frac{1 - \cos^2(x - 2)}{3x^2 - 12x + 12} = \dots\dots\dots$$

**Jawab :**

$$\lim_{x \rightarrow 2} \frac{\sin^2(x - 2)}{(x - 2)(3x - 6)} = \lim_{x \rightarrow 2} \frac{\sin(x - 2)}{x - 2} \cdot \frac{\sin(x - 2)}{x - 2} \cdot \frac{1}{3} = \frac{1}{3}$$

$$64. \lim_{x \rightarrow -2} \frac{(x + 6) \sin(x + 2)}{x^2 - 3x - 10} = \dots\dots\dots$$

**Jawab :**

$$\lim_{x \rightarrow -2} \frac{x + 6}{x - 5} \cdot \frac{\sin(x + 2)}{x + 2} = -\frac{4}{7}$$

$$65. \lim_{x \rightarrow \pi} \frac{x^2 \sin 2x}{x - \pi} = \dots\dots\dots$$

**Jawab :**

$$\lim_{x \rightarrow \pi} \frac{2x \sin 2x + 2x^2 \cos 2x}{1} = 0 + 2\pi^2 = 2\pi^2$$