1. $\lim\limits_{\theta \to 0} \dfrac{\sin^4 3\theta}{2\theta^4} = \dfrac{1}{2} \lim\limits_{\theta \to 0} \left(\dfrac{3\sin 3\theta}{3\theta} \right)^4 = \dfrac{81}{2} \left[\lim\limits_{\theta \to 0} \dfrac{\sin 3\theta}{3\theta} \right]^4$

$= \dfrac{81}{2}(1^4) = \boxed{\dfrac{81}{2}}$

2. $\lim\limits_{x \to 0} \dfrac{3 - 3\cos^2 x}{5x} = \lim\limits_{x \to 0} \dfrac{3(1-\cos^2 x)}{5x} = \dfrac{3}{5} \lim\limits_{x \to 0} \dfrac{\sin^2 x}{x}$

$= \dfrac{3}{5} \left(\lim\limits_{x \to 0} \dfrac{\sin x}{x} \right) \left(\lim\limits_{x \to 0} \sin x \right) = \left(\dfrac{3}{5}\right)(1)(0) = \boxed{0}$

3. $\lim\limits_{x \to 0} \dfrac{\sin 3x}{\sin 7x} = \lim\limits_{x \to 0} \dfrac{3\sin 3x}{1(3x)} \cdot \dfrac{1(7x)}{7\sin 7x} = \dfrac{3}{7} \left(\lim\limits_{x \to 0} \dfrac{\sin 3x}{3x} \right) \left(\lim\limits_{x \to 0} \dfrac{7x}{\sin 7x} \right)$

$= \dfrac{3}{7}(1)(1) = \boxed{\dfrac{3}{7}}$

4. $\lim\limits_{\theta \to 0} \dfrac{\theta^2 - 1 + \cos\theta}{\sin^2\theta} = \lim\limits_{\theta \to 0} \dfrac{\theta^2}{\sin^2\theta} - \lim\limits_{\theta \to 0} \dfrac{1-\cos\theta}{\sin^2\theta}$

$= \left(\lim\limits_{\theta \to 0} \dfrac{\theta}{\sin\theta} \right)^2 - \lim\limits_{\theta \to 0} \dfrac{1-\cos\theta}{1-\cos^2\theta} = (1)^2 - \lim\limits_{\theta \to 0} \dfrac{1-\cos\theta}{(1-\cos\theta)(1+\cos\theta)}$

$= 1 - \lim\limits_{\theta \to 0} \dfrac{1}{1+\cos\theta} = 1 - \dfrac{1}{1+1} = 1 - \dfrac{1}{2} = \boxed{\dfrac{1}{2}}$

5. $\lim\limits_{t \to 0} \dfrac{\tan^3(3t)}{t^3} = \lim\limits_{t \to 0} \left(\dfrac{3\tan 3t}{3t} \right)^3$

$= 27 \left[\lim\limits_{t \to 0} \dfrac{\tan 3t}{3t} \right]^3 = 27(1^3) = \boxed{27}$

6. $$\lim_{x\to 0} \frac{1-3x^2-2\cos x+\cos^2 x}{x^2}$$

$$= \lim_{x\to 0} \frac{-3x^2}{x^2} + \lim_{x\to 0} \frac{1-2\cos x+\cos^2 x}{x^2} = \lim_{x\to 0} -3 + \lim_{x\to 0} \frac{(1-\cos x)^2}{x^2}$$

$$= -3 + \left[\lim_{x\to 0} \frac{1-\cos x}{x}\right]^2 = -3+0^2 = \boxed{-3}$$

7. $$\lim_{u\to 0} \frac{\sin^3 4u}{32u^3} = \lim_{u\to 0} \frac{2\sin^3 4u}{64u^3} = 2\left(\lim_{u\to 0} \frac{\sin 4u}{4u}\right)^3$$

$$= 2(1^3) = \boxed{2}$$

8. $$\lim_{x\to\infty} \frac{3x^3-6x+1}{6x^2+2x-7} = \lim_{x\to\infty} \frac{\frac{3x^3-6x+1}{x^3}}{\frac{6x^2+2x-7}{x^3}} = \lim_{x\to\infty} \frac{3-\frac{6}{x^2}+\frac{1}{x^3}}{\frac{6}{x}+\frac{2}{x^2}-\frac{7}{x^3}}$$

$$= \frac{3-0+0}{0+0-0} = \frac{3}{0} \to \boxed{DNE}$$

9. $$\lim_{x\to -\infty} \frac{2x+7}{7x-1} = \lim_{x\to -\infty} \frac{\frac{2x+7}{x}}{\frac{7x-1}{x}} = \lim_{x\to -\infty} \frac{2+\frac{7}{x}}{7-\frac{1}{x}}$$

$$= \lim_{x\to -\infty} \frac{2}{7} = \boxed{\frac{2}{7}}$$

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

$$= \frac{0-0+0}{1+0+0} = \frac{0}{1} = \boxed{0}$$

11. $\lim_{x\to-\infty} \frac{5x-7}{\sqrt{4x^2+5}} = \lim_{x\to-\infty} \frac{\frac{5x-7}{|x|}}{\sqrt{\frac{4x^2+5}{x^2}}} = \lim_{x\to-\infty} \frac{\frac{5x-7}{-x}}{\sqrt{4+\frac{5}{x^2}}} = \lim_{x\to-\infty} \frac{-5+\frac{7}{x}}{\sqrt{4+\frac{5}{x^2}}}$

$= \frac{-5}{\sqrt{4}} = \boxed{-\frac{5}{2}}$

12. $\lim_{x\to\infty} 2e^{2x}+3e = \boxed{\infty}$

13. $\lim_{x\to-\infty} \left(e^{10x}-9e^{3x}+e^{2x}-3e^{-2x}+3e^{-11x}\right)$

$= \lim_{x\to-\infty} e^{-11x}\left(e^{21x}-9e^{14x}+e^{13x}-3e^{9x}+3\right)$

$= \infty(0-0+0-0+3) = \boxed{\infty}$

14. $\lim_{x\to\infty} \left(3e^{3x}+2e^{2x}-3e^{-3x}+5e^{-7x}\right)$

$= \infty+\infty-0+0 = \boxed{\infty}$

16. $\lim_{x\to-\infty} \ln\left(\frac{7}{x^6-5x}\right)$ let $u=\frac{7}{x^6-5x}$ $x\to-\infty$ $u\to0^+$

$= \lim_{u\to0^+} \ln u = \boxed{-\infty}$

15. $\lim_{x\to-\infty} \ln(2x^4-x+5)$ $u=2x^4-x+5$ $x\to-\infty$ $u\to\infty$

$= \lim_{u\to\infty} \ln u = \boxed{\infty}$