

L'Hôpital's Rule (1)

Day 5 Curve Sketching

1-3: Given that

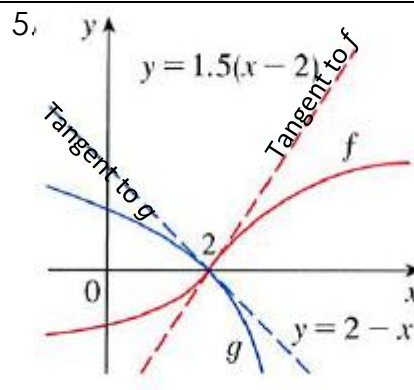
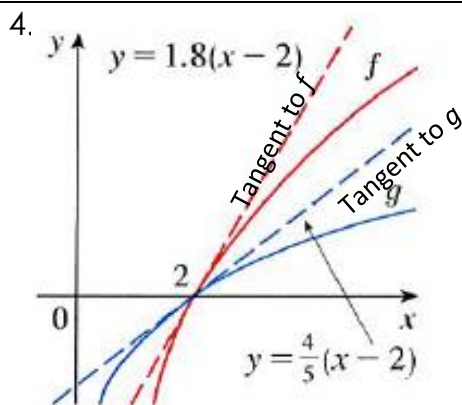
$$\lim_{x \rightarrow a} f(x) = 0 \quad \lim_{x \rightarrow a} g(x) = 0 \quad \lim_{x \rightarrow a} h(x) = 1$$

$$\lim_{x \rightarrow a} p(x) = \infty \quad \lim_{x \rightarrow a} q(x) = \infty$$

Which of the following limits are indeterminate? For those that are not an indeterminate from, evaluate the limit where possible.

1.	2.	3.
a.) $\lim_{x \rightarrow a} \frac{f(x)}{g(x)}$	a.) $\lim_{x \rightarrow a} [f(x)p(x)]$	a.) $\lim_{x \rightarrow a} [f(x) - p(x)]$
b.) $\lim_{x \rightarrow a} \frac{f(x)}{p(x)}$	b.) $\lim_{x \rightarrow a} [h(x)p(x)]$	b.) $\lim_{x \rightarrow a} [p(x) - q(x)]$
c.) $\lim_{x \rightarrow a} \frac{h(x)}{p(x)}$	c.) $\lim_{x \rightarrow a} [p(x)q(x)]$	c.) $\lim_{x \rightarrow a} [p(x) + q(x)]$
d.) $\lim_{x \rightarrow a} \frac{p(x)}{f(x)}$		
e.) $\lim_{x \rightarrow a} \frac{p(x)}{q(x)}$		

4-5: Use the graphs of f and g and their tangent lines at $(2,0)$ to find $\lim_{x \rightarrow 2} \frac{f(x)}{g(x)}$.



6-20: Find the limit. Use *L'Hôpital's Rule* where appropriate. If there is a more elementary method, consider using it. If *L'Hôpital's Rule* doesn't apply, explain why.

6. $\lim_{x \rightarrow \frac{1}{2}} \frac{6x^2 + 5x - 4}{4x^2 + 16x - 9}$

7. $\lim_{x \rightarrow \frac{\pi}{2}^+} \frac{\cos x}{1 - \sin x}$

8. $\lim_{t \rightarrow 0} \frac{e^{2t} - 1}{\sin t}$

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$$9. \lim_{\theta \rightarrow \frac{\pi}{2}} \frac{1 - \sin \theta}{1 + \cos 2\theta}$$

$$10. \lim_{x \rightarrow \infty} \frac{\ln x}{\sqrt{x}}$$

$$11. \lim_{x \rightarrow 0^+} \frac{\ln x}{x}$$

$$12. \lim_{x \rightarrow 0} \frac{e^x - 1 - x}{x^2}$$

$$13. \lim_{x \rightarrow 0} \frac{x - \sin x}{x - \tan x}$$

$$14. \lim_{x \rightarrow \infty} \frac{(\ln x)^2}{x}$$

$$15. \lim_{x \rightarrow 0} \frac{\cos mx - \cos nx}{x^2}$$

$$16. \lim_{x \rightarrow 0} \frac{e^x - e^{-x} - 2x}{x - \sin x}$$

$$17. \lim_{x \rightarrow \infty} x \sin\left(\frac{\pi}{x}\right)$$

$$18. \lim_{x \rightarrow 0^+} \sin x \ln x$$

$$19. \lim_{x \rightarrow \infty} \sqrt{x} e^{-\frac{x}{2}}$$

$$20. \lim_{x \rightarrow \infty} x^3 e^{-x^2}$$

Answers:

- | | | | | | |
|----|----------------------|------------------|----------------|------------------|------------------|
| 1 | a) Indeterminate | b) 0 | c) 0 | d) Indeterminate | e) Indeterminate |
| 2 | a) Indeterminate | b) ∞ | c) ∞ | | |
| 3 | a) $-\infty$ | b) Indeterminate | c) ∞ | | |
| 4 | $\frac{9}{4}$ | | 5 | -1.5 | |
| 6 | $\frac{11}{20}$ | 7 | $-\infty$ | 8 | 2 |
| 9 | $\frac{1}{4}$ | 10 | 0 | 11 | $-\infty$ |
| 12 | $\frac{1}{2}$ | 13 | $-\frac{1}{2}$ | 14 | 0 |
| 15 | $\frac{-m^2+n^2}{2}$ | 16 | 2 | 17 | π |
| 18 | 0 | 19 | 0 | 20 | 0 |