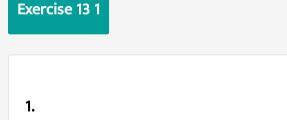


# MATHS

# **NCERT - NCERT MATHEMATICS (ENGLISH)**

# LIMITS AND DERIVATIVES



#### Suppose

 $f(x)=\left[a+bx,\,x<1,\,4,\,x=1,\,b-ax,\,x>1
ight] ext{ and } \lim \,f(x) where x tends$ 

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2. Let  $a_1, a_2, \ldots, a_n$  be fixed real numbers and define a function f(x) =  $(x - a_1)(x - a_2)\ldots (x - a_n)$ . What is  $(\lim)_{x \to a_1} f(x)$ ? For some  $a \neq a_1, a_2, \ldots, a_n$ , compute  $(\lim)_{x \to a} f(x)$ 



**3.** 
$$(\lim_{x \to \frac{\pi}{2}} \frac{\tan 2x}{x - \frac{\pi}{2}})$$

**4.** 
$$(\lim_{x \to 0} \frac{\sin ax + bx}{ax + \sin bx}a, b, a + b \neq 0$$

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5. Evaluate 
$$(\lim)_{x
ightarrow 0}f(x), \; where \; f(x)=iggl\{rac{|x|}{x},\; x
eq 0,0,\; x=0$$

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**6.** Find 
$$(\lim_{x o 5} f(x),$$
 where  $f(x) = |x| - 5$ 

7. Find 
$$(\ \lim \ )_{x o 1} f(x)$$
 ,where  $f(x) = egin{cases} x^2 - 1 & x \leq 1 \ -x^2 - 1 & x > 1 \end{cases}$ 

**8.** Evaluate 
$$(\lim)_{x
ightarrow 0}f(x), \; where \; f(x)=iggl\{rac{|x|}{x},\; x
eq 0,0,\; x=0$$

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9. If the function f(x) satisfies  $(\lim_{x o 1})_{x o 1} rac{f(x)-2}{x^2-1} = \pi,$  evaluate  $(\lim_{x o 1})_{x o 1} f(x)$ 

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10. If f(x) = [|x|+1, x < 00, x = 0|x|-1, x > 0]

11. If  $f(x) = igl[mx^2+n, x < 0nx+m, x \le x \le 1nx^3+m, x > 1.$  For

what integers m and n does both  $(\ \lim \ )_{x\,
ightarrow\,1}f(x)$  .

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#### 12.

Find

 $f(x) and ( \ \lim \ )_{x \, 
ightarrow \, 1} f(x), where f(x) = [2x + 3, x \leq 03(x + 1), x > 0]$ 

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**13.** 
$$(\lim_{x \to 0})_{x \to 0} (\cos ecx - \cot x)$$

14. 
$$(\lim_{x \to 3} \frac{x^4 - 81}{2x^2 - 5x - 3}$$

**15.** 
$$(\lim_{x \to 0})_{x \to 0} \frac{ax+b}{cx+1}$$



16. Evaluate: 
$$(\lim_{x \to 4} \frac{4x+3}{x-2})$$

17. 
$$(\ \lim \ )_{x \, o \, -1} rac{x^{10} + x^5 + 1}{x - 1}$$

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**18.** 
$$(\lim_{x \to 0} \frac{(x+1)^5 - 1}{x}$$

**19.** 
$$(\lim_{x \to 2} \frac{3x^2 - x - 10}{x^2 - 4})$$

**20.** 
$$(\lim_{x\to 3} x + 3)$$

**21.** 
$$(\lim)_{x \to \pi} \left(x - \frac{22}{7}\right)$$

**22.** Find 
$$(\ \lim \ )_{r 
ightarrow 1} \pi r^2$$

**23.** 
$$(\lim_{x \to 0} x \sec x)$$



**24.** 
$$(\lim_{x \to 0} \frac{ax + x \cos x}{b \sin x})$$



**25.** 
$$(\lim_{x \to 0} \frac{\cos 2x - 1}{\cos x - 1})$$

**26.** 
$$(\lim_{x \to 0} \frac{\cos x}{\pi - x})$$



**27.** 
$$(\lim_{x \to \pi} \frac{\sin(\pi - x)}{\pi(\pi - x)}$$

**28.** 
$$(\lim_{x \to 0} \frac{sinax}{\sin bx}a, b, \neq 0$$

**29.** 
$$(\lim_{x \to 0} \frac{\sin ax}{bx})$$

**30.** ( lim )<sub>x \rightarrow 2</sub> 
$$\frac{\frac{1}{x} + \frac{1}{2}}{x+2}$$

**31.** 
$$\lim_{x o 1} \frac{ax^2 + bx + c}{cx^2 + bx + a}, a + b + c \neq 0$$

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**32.** 
$$(\lim_{z \to 1} \frac{z^{\frac{1}{3}} - 1}{z^{\frac{1}{6}} - 1}$$

1. Find the derivative of f (x) from the first principles, where f(x) is(i)

$$s \in x + \cos x$$
 (ii)  $xs \in x$ 

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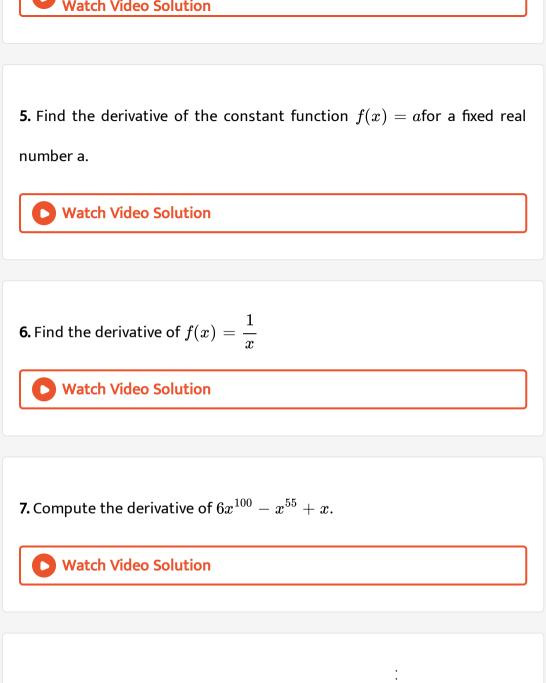
**2.** Find the derivative of(i) 
$$rac{x^5 - \cos x}{\sin x}$$
 (ii)  $rac{x + \cos x}{\tan x}$ 

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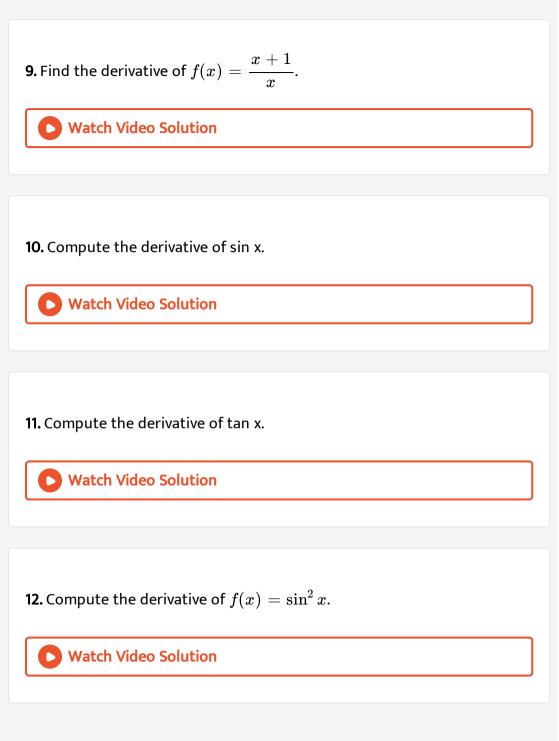
3. Compute derivative of (i)  $f(x) = \sin 2x$  (ii)  $g(x) = \cot x$ 



**4.** Find the derivative of  $f(x) = x^2$ 



8. Find the derivative of  $f(x)=1+x+x^2+x^3++x^{50}$  at x=1.



13. Find the derivative of f from the first principles, where f is given by(i)

$$f(x)=rac{2x+3}{x-2}$$
 (ii)  $f(x)=x+rac{1}{x}$ 

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14. Evaluate(i) 
$$(\lim_{x \to 1} \frac{x^{15} - 1}{x^{10} - 1}$$
 (ii)  $(\lim_{x \to 0} \frac{\sqrt{1 + x} - 1}{x})$ 

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**15.** Find the limits (i) 
$$(\lim_{x \to 1} \left[ \frac{x^2 + 1}{x + 100} \right]$$
 (ii)  
 $(\lim_{x \to 2} \left[ \frac{x^3 - 4x^2 + 4x}{x^2 - 4} \right]$ 

**16.** Find the limits: (i)  $(\lim_{x \to 1} [x^3 - x^2 + 1]$  (iii)  $(\lim_{x \to 3} [x(x+1)]$ (iii)  $(\lim_{x \to 1} [1 + x + x^2 + \ldots + x^{10}]$ 

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18. Find the derivative of the function  $f(x) = 2x^2 + 3x - 5$ at x = 1.

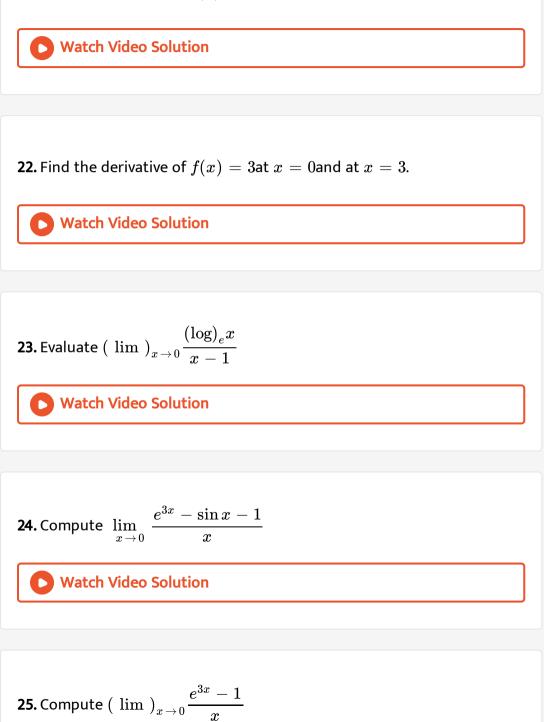
Also prove that f'(0) + 3f'(-1) = 0.

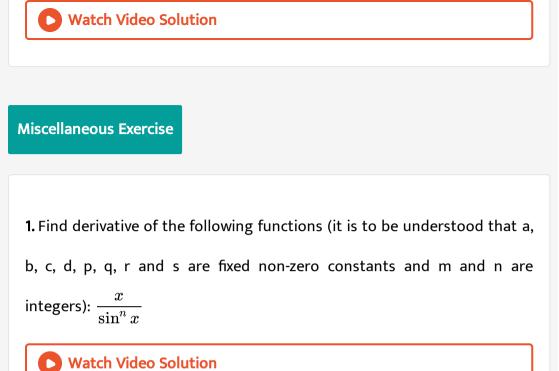
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**19.** Find the derivative at x = 2 of the function f(x) = 3x.

**20.** Evaluate (i)  $(\lim_{x \to 0} \frac{\sin 4x}{\sin 2x}$  (ii)  $(\lim_{x \to 0} \frac{\tan x}{x})$ 

**21.** Find the derivative of f(x) = 10x.





**2.** Find derivative of the following functions (it is to be understood that a, b, c, d, p, q, r and s are fixed non-zero constants and m and n are integers): (x + a)



**3.** Find derivative of the following functions (it is to be understood that a, b, c, d, p, q, r and s are fixed non-zero constants and m and n are integers):  $(px + q)\left(\frac{r}{x} + s\right)$ 

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4. Find the derivative of the following functions from first principle:

(i) -x (ii) 
$$(-x)^{-1}$$
 (iii)  $\sin(x+1)$  (iv)  $\cos\left(x-rac{\pi}{8}
ight)$ 

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5. Find derivative of the following functions (it is to be understood that a,

b, c, d, p, q, r and s are fixed non-zero constants and m and n are integers):  $\frac{1+\frac{1}{x}}{1-\frac{1}{x}}$ 

**6.** Find derivative of the following functions (it is to be understood that a, b, c, d, p, q, r and s are fixed non-zero constants and m and n are integers):  $\frac{1}{ax^2 + bx + c}$ 

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7. Find derivative of the following functions (it is to be understood that a, b, c, d, p, q, r and s are fixed non-zero constants and m and n are integers):  $(ax + b)(cx + d)^2$ 

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**8.** Find derivative of the following functions (it is to be understood that a, b, c, d, p, q, r and s are fixed non-zero constants and m and n are integers):  $\frac{ax + b}{cx + d}$ 

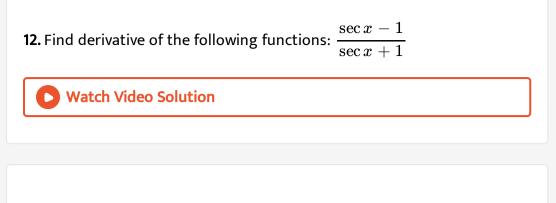
**9.** Find derivative of the following functions (it is to be understood that a, b, c, d, p, q, r and s are fixed non-zero constants and m and n are integers):  $\frac{ax + b}{px^2 + qx + r}$ Watch Video Solution

**10.** Find derivative of the following functions (it is to be understood that a, b, c, d, p, q, r and s are fixed non-zero constants and m and n are integers):  $\frac{px^2 + qx + r}{ax + b}$ 

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**11.** Find derivative of the following functions (it is to be understood that a, b, c, d, p, q, r and s are fixed non-zero constants and m and n are integers):  $\sin^n x$ 





13. Find derivative of the following functions (it is to be understood that

a, b, c, d, p, q, r and s are fixed non-zero constants and m and n are

integers):  $\cos ecx \cot x$ 

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14. Find derivative of the following functions (it is to be understood that

a, b, c, d, p, q, r and s are fixed non-zero constants and m and n are integers): sin (x + a)

**15.** Find derivative of the following functions (it is to be understood that a, b, c, d, p, q, r and s are fixed non-zero constants and m and n are integers):  $\frac{\sin x + \cos x}{\sin x - \cos x}$ 

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**16.** Find derivative of the following functions (it is to be understood that a, b, c, d, p, q, r and s are fixed non-zero constants and m and n are integers):  $\frac{\cos x}{1 + \sin x}$ 

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17. Find derivative of the following functions (it is to be understood that a, b, c, d, p, q, r and s are fixed non-zero constants and m and n are integers):  $4\sqrt{x} - 2$ 

**18.** Find derivative of the following functions (it is to be understood that a, b, c, d, p, q, r and s are fixed non-zero constants and m and n are integers):  $\frac{a}{x^4} - \frac{b}{x^2} + \cos x$ 

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**19.** Find derivative of the following functions (it is to be understood that a, b, c, d, p, q, r and s are fixed non-zero constants and m and n are integers):  $(ax + b)^n (cx + d)^m$ 



**20.** Find derivative of the following functions (it is to be understood that a, b, c, d, p, q, r and s are fixed non-zero constants and m and n are integers):  $(ax + b)^n$ 

**21.** Find derivative of the following functions (it is to be understood that a, b, c, d, p, q, r and s are fixed non-zero constants and m and n are integers):  $(ax^2 + \sin x)(p + q\cos x)$ 

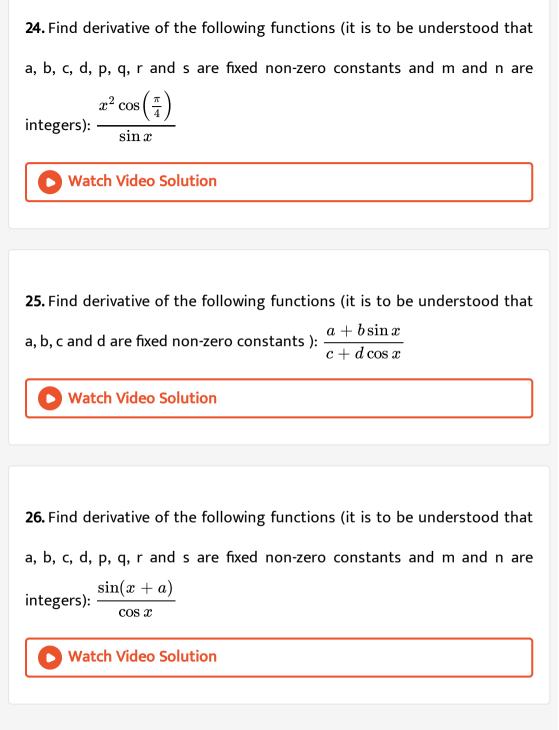


**22.** Find derivative of the following functions (it is to be understood that a, b, c, d, p, q, r and s are fixed non-zero constants and m and n are integers):  $(x + \cos x)(xtanx)$ 



**23.** Find derivative of the following functions (it is to be understood that a, b, c, d, p, q, r and s are fixed non-zero constants and m and n are integers):  $\frac{4x + 5 \sin x}{3x + 7 \cos x}$ 





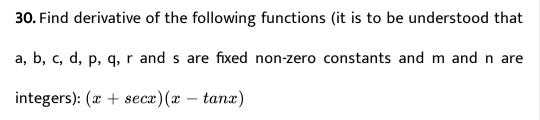
27. Find derivative of the following functions (it is to be understood that a, b, c, d, p, q, r and s are fixed non-zero constants and m and n are integers):  $x^4(5\sin x - 3\cos x)$ 

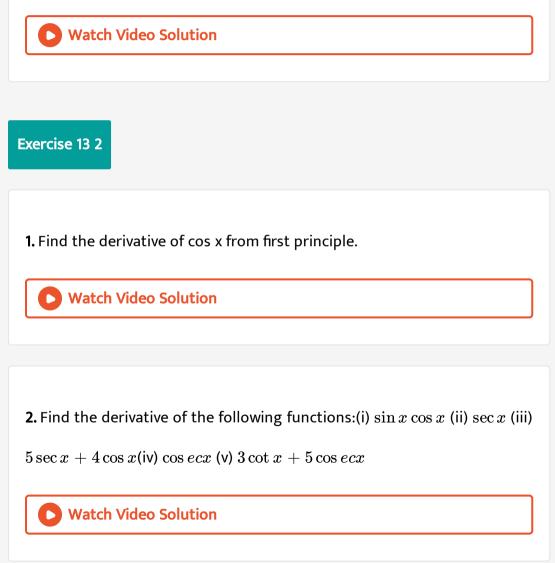


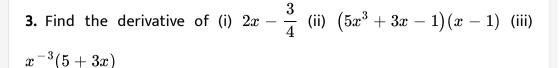
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**28.** Find derivative of the following functions (it is to be understood that a, b, c, d, p, q, r and s are fixed non-zero constants and m and n are integers):  $(x^2 + 1)\cos x$ 











**4.** Find the derivative of 
$$\frac{x^n - a^n}{x - a}$$
 for some constant a.

**5.** Find the derivative of 
$$x^2 - 2at x = 10$$
.

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**6.** Find the derivative of x at x = 1.

## 7. Find the derivative of 99x at x = 100.



8. For the function

$$f(x)=rac{x^{100}}{100}+rac{x^{99}}{99}+...+rac{x^2}{2}+x+1$$

. Prove that f'(1) = 100 f'(0).

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9. Find the derivative of the following functions from first principle.(i)

$$x^3-27$$
 (ii)  $(x-1)(x-2)$  (iii)  $rac{1}{x^2}$  (iv)  $rac{x+1}{x-1}$ 

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10. For some constants a and b, find the derivative of(i)  $(x - a) \cdot (x - b)$ (ii)  $(ax^2 + b)^2$  (iii)  $\frac{x - a}{x - b}$ 



