

First Derivative Test

1-18

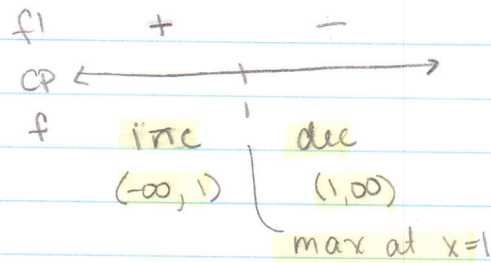
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1. $f(x) = -2x^2 + 4x + 3$

$f'(x) = -4x + 4$

$0 = -4x + 4$

CP $x = 1$

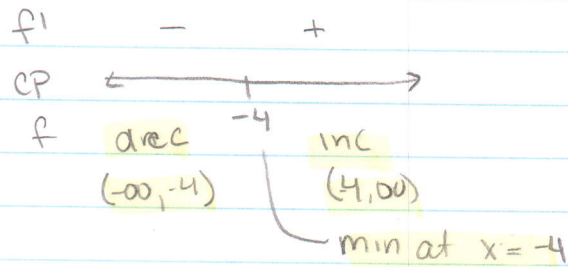


2. $f(x) = x^2 + 8x + 10$

$f'(x) = 2x + 8$

$0 = 2x + 8$

CP $x = -4$

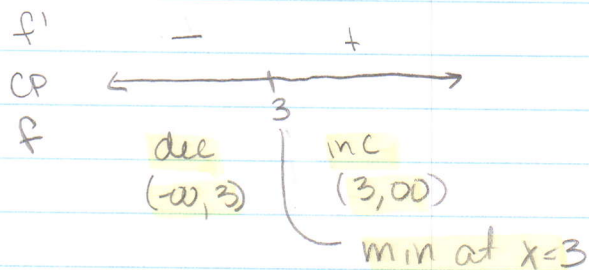


3. $f(x) = x^2 - 6x$

$f'(x) = 2x - 6$

$0 = 2x - 6$

CP $x = 3$



$(x-1)^2$ \times $x+2$
 $2(x-1)$ 1

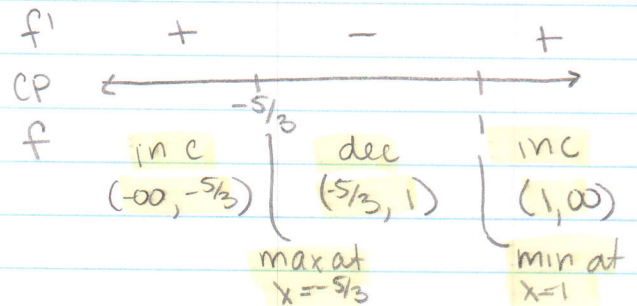
4. $f(x) = (x-1)^2(x+2)$

$f'(x) = 2(x-1)(x+2) + (x+1)^2$

$= (x-1)[2(x+2) + (x+1)]$

$0 = (x-1)[3x+5]$

CP $x = 1, -5/3$



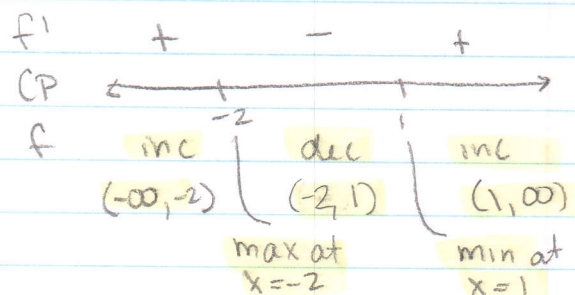
5. $f(x) = 2x^3 + 3x^2 - 12x$

$f'(x) = 6x^2 + 6x - 12$

$0 = 6(x^2 + x - 2)$

$0 = 6(x+2)(x-1)$

CP $x = -2, 1$

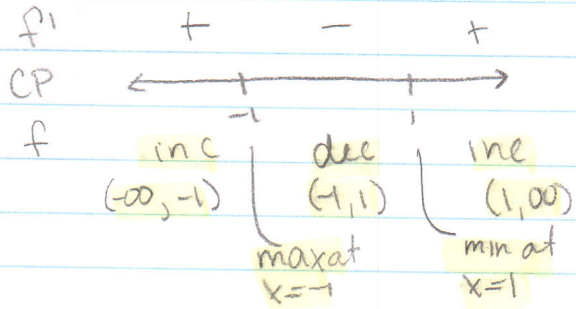


6. $f(x) = \frac{x^5}{5} - x$

$f'(x) = x^4 - 1$

$0 = (x^2+1)(x^2-1)$

CP $x = \pm 1$



$\frac{x^2}{2x} \circlearrowright \frac{x^2-a}{2x}$

7. $f(x) = \frac{x^2}{x^2-a}$ VA $x = \pm 3$

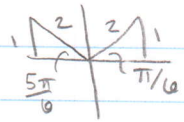
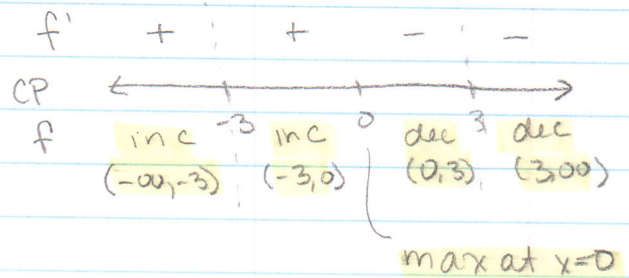
$f'(x) = \frac{2x(x^2-a) - 2x(x^2)}{(x^2-a)^2} = \frac{-18x}{(x^2-a)^2}$

$0 = -18x$

CP $x = 0$

$(x^2-a)^2 = 0$

CP $x = \pm 3$



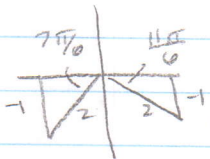
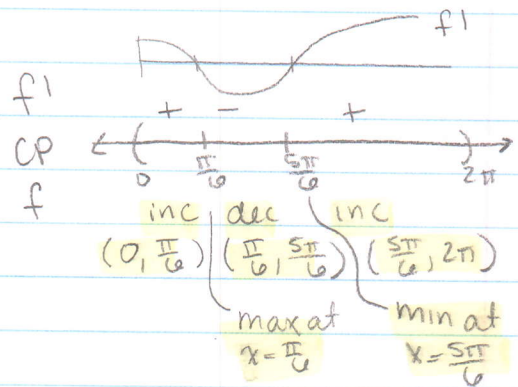
8. $f(x) = \frac{x}{2} + \cos x$ on $[0, 2\pi]$

$f'(x) = \frac{1}{2} - \sin x$

$0 = \frac{1}{2} - \sin x$

$\sin x = \frac{1}{2}$

CP $x = \frac{\pi}{6}, \frac{5\pi}{6}$



9. $f(x) = \sin^2(x) + \sin x$ on $[0, 2\pi]$

$f'(x) = 2\sin x \cdot \cos x + \cos x$

$0 = \cos x (2\sin x + 1)$

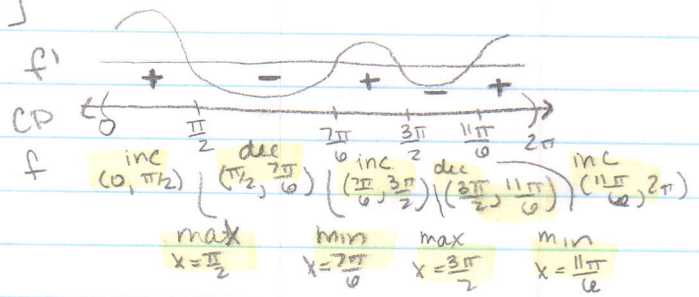
$\cos x = 0$

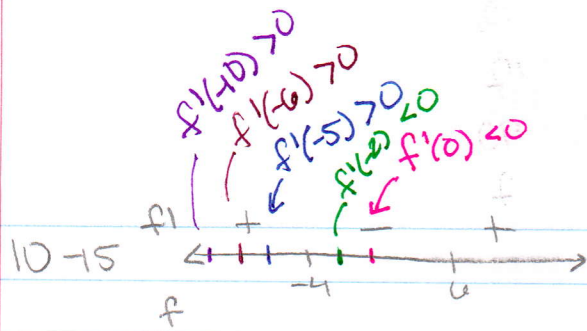
$2\sin x + 1 = 0$

CP $x = \frac{\pi}{2}, \frac{3\pi}{2}$

$\sin x = -1/2$

CP $x = \frac{7\pi}{6}, \frac{11\pi}{6}$





10. $g(x) = f(x) + 5$
 $g'(x) = f'(x)$
 $g'(0) = f'(0) < 0$

11. $g(x) = 3f(x) - 3$
 $g'(x) = 3f'(x)$
 $g'(-5) = 3f'(-5) > 0$

12. $g(x) = -f(x)$
 $g'(x) = -f'(x)$
 $g'(-6) = -f'(-6) < 0$

13. $g'(0) = -f'(0) > 0$

Chain rule

14. $g(x) = f(x-10)$
 $g'(x) = f'(x-10) \cdot 1$
 $g'(0) = f'(0-10) = f'(-10) > 0$

15. $g'(8) = f'(8-10) = f'(-2) < 0$

$x^2 e^{kx}$
 $2x \quad ke^{kx}$

16. $g'(2/3) = 0 \leftarrow \text{CP at } x = 2/3$
 $g'(x) = 2xe^{kx} + kx^2e^{kx}$
 $0 = xe^{kx}(2 + kx)$
 $x = 2/3$
 $0 = \frac{2}{3} \cdot e^{\frac{2}{3}k} \cdot (2 + \frac{2}{3}k)$
 $\neq 0 \quad = 0$
 when $k = -3$
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