Math 122: Test 3 Review
PROBLEMS FROM PAGES 157-158
Problem 1:

\[ f(t) = 6 t^4 \]
\[ f'(t) = ? \]
Problem 1:

\[ f(t) = 6t^4 \]
\[ f'(t) = 6 \]
Problem 1:

\[ f(t) = 6 t^4 \]
\[ f'(t) = 6 (4t^4 - 1) \]
Problem 1:

\[ f(t) = 6t^4 \]
\[ f'(t) = 6(4t^3) \]
Problem 1:

\[ f(t) = 6t^4 \]
\[ f'(t) = 24t^3 \]
Problem 6:

\[ y = 5e^{-0.2t} \]

\[ y' = ? \]
Problem 6:

\[ y = 5e^{-0.2t} \]
\[ y' = 5 \]
Problem 6:

\[ y = 5e^{-0.2t} \]
\[ y' = 5(e^{-0.2t}) \]
Problem 6:

\[ y = 5e^{-0.2t} \]
\[ y' = 5(e^{-0.2t}(-0.2)) \]
Problem 6:

\[ y = 5e^{-0.2t} \]
\[ y' = 5(e^{-0.2t}(-0.2)) \]
Problem 6:

\[ y = 5e^{-0.2t} \]

\[ y' = -e^{-0.2t} \]
Problem 7:

\[ s(t) = (t^2 + 4)(5t - 1) \]

\[ s'(t) = ? \]
Problem 7:

\[ s(t) = (t^2 + 4)(5t - 1) \]
\[ s'(t) = 2t \cdot (5t - 1) + (t^2 + 4) \cdot 5 \]
Problem 7:

\[ s(t) = (t^2 + 4)(5t - 1) \]
\[ s'(t) = 2t \cdot (5t - 1) + (t^2 + 4) \cdot 5 \]
Problem 7:

\[ s(t) = (t^2 + 4)(5t - 1) \]

\[ s'(t) = 2t \cdot (5t - 1) + (t^2 + 4) \cdot 5 \]

= ?
Problem 7:

\[ s(t) = (t^2 + 4)(5t - 1) \]
\[ s'(t) = 2t \cdot (5t - 1) + (t^2 + 4) \cdot 5 \]
\[ = 15t^2 \]
Problem 7:

\[ s(t) = (t^2 + 4)(5t - 1) \]
\[ s'(t) = 2t \cdot (5t - 1) + (t^2 + 4) \cdot 5 \]
\[ = 15t^2 - 2t \]
Problem 7:

\[ s(t) = (t^2 + 4)(5t - 1) \]
\[ s'(t) = 2t \cdot (5t - 1) + (t^2 + 4) \cdot 5 \]
\[ = 15t^2 - 2t + 20 \]
Problem 7:

\[ s(t) = (t^2 + 4)(5t - 1) \]
\[ s'(t) = 2t \cdot (5t - 1) + (t^2 + 4) \cdot 5 \]
\[ = 15t^2 - 2t + 20 \]
Problem 8:

\[ g(t) = e^{(1+3t)^2} \]

\[ g'(t) = ? \]
Problem 8:

\[ g(t) = e^{(1+3t)^2} \]

\[ g'(t) = ? \]
Problem 8:

\[ g(t) = e^{(1+3t)^2} \]
\[ g'(t) = e^{(1+3t)^2} \]
Problem 8:

\[ g(t) = e^{(1+3t)^2} \]

\[ g'(t) = e^{(1+3t)^2} \cdot 2 \cdot (1+3t) \]
Problem 8:

\[ g(t) = e^{(1+3t)^2} \]
\[ g'(t) = e^{(1+3t)^2} \cdot 2 \cdot (1+3t) \cdot 3 \]
Problem 8:

\[ g(t) = e^{(1+3t)^2} \]
\[ g'(t) = e^{(1+3t)^2} \cdot 2 \cdot (1+3t) \cdot 3 \]
\[ = 6(1 + 3t)e^{(1+3t)^2} \]
Problem 13:

\[ f(z) = \ln(z^2 + 1) \]

\[ f'(z) = ? \]
Problem 13:

\[ f(z) = \ln(z^2 + 1) \]

\[ f'(z) = \frac{1}{z^2 + 1} \]
Problem 13:

\[ f(z) = \ln(z^2 + 1) \]

\[ f'(z) = \frac{1}{z^2 + 1} \]
Problem 13:

\[ f(z) = \ln(z^2 + 1) \]

\[ f'(z) = \frac{2z}{z^2 + 1} \]
Problem 13:

\[ f(z) = \ln(z^2 + 1) \]

\[ f'(z) = \frac{2z}{z^2 + 1} \]
Problem 14:

\[ y = xe^{3x} \]

\[ y' = ? \]
Problem 14:

\[ y = x e^{3x} \]

\[ y' = 1 \cdot e^{3x} + x \cdot e^{3x} \cdot 3 \]
Problem 14:

\[ y = xe^{3x} \]

\[ y' = 1 \cdot e^{3x} + x \cdot e^{3x} \cdot 3 \]
Problem 14:

\[ y = xe^{3x} \]
\[ y' = e^{3x} + 3xe^{3x} \]
Problem 14:

\[ y = xe^{3x} \]

\[ y' = e^{3x} + 3xe^{3x} \]

\[ = e^{3x}(1 + 3x) \]
Problem 14:

\[ y = xe^{3x} \]

\[ y' = e^{3x} + 3xe^{3x} \]

\[ = e^{3x}(1 + 3x) \]

\[ = (3x + 1)e^{3x} \]
Problem 23:

\[ g(x) = \frac{25x^2}{e^x} \]

\[ g'(x) = ? \]
Problem 23:

\[ g(x) = \frac{25x^2}{e^x} \]

\[ g'(x) = \frac{(e^x)^2}{(e^x)^2} \]
Problem 23:

\[ g(x) = \frac{25x^2}{e^x} \]

\[ g'(x) = \frac{e^x \cdot 25 \cdot 2x}{(e^x)^2} \]
Problem 23:

\[ g(x) = \frac{25x^2}{e^x} \]

\[ g'(x) = \frac{e^x \cdot 25 \cdot 2x}{(e^x)^2} \]
Problem 23:

\[ g(x) = \frac{25x^2}{e^x} \]

\[ g'(x) = \frac{e^x \cdot 25 \cdot 2x - 25x^2 \cdot e^x}{(e^x)^2} \]
Problem 23:

\[ g(x) = \frac{25x^2}{e^x} \]

\[ g'(x) = \frac{e^x \cdot 25 \cdot 2x - 25x^2 \cdot e^x}{(e^x)^2} \]
Problem 23:

\[ g(x) = \frac{25x^2}{e^x} \]

\[ g'(x) = \frac{e^x \cdot 25 \cdot 2x - 25x^2 \cdot e^x}{(e^x)^2} \]

\[ = \frac{25 \cdot 2x - 25x^2}{e^x} \]
Problem 23:

\[ g(x) = \frac{25x^2}{e^x} \]

\[ g'(x) = \frac{e^x \cdot 25 \cdot 2x - 25x^2 \cdot e^x}{(e^x)^2} \]

\[ = \frac{50x - 25x^2}{e^x} \]
Problem 23:

\[ g(x) = \frac{25x^2}{e^x} \]

\[ g'(x) = \frac{e^x \cdot 25 \cdot 2x - 25x^2 \cdot e^x}{(e^x)^2} = \frac{25x(2 - x)}{e^x} \]
Problem 23:

\[ g(x) = \frac{25x^2}{e^x} \]

\[ g'(x) = \frac{e^x \cdot 25 \cdot 2x - 25x^2 \cdot e^x}{(e^x)^2} \]

\[ = -25x(x - 2)e^{-x} \]
Problem 25:

\[ f(x) = \ln(1 + e^x) \]

\[ f'(x) = ? \]
Problem 25:

\[ f(x) = \ln(1 + e^x) \]

\[ f'(x) = \quad \]
Problem 25:

\[ f(x) = \ln(1 + e^x) \]

\[ f'(x) = \frac{1}{1 + e^x} \]
Problem 25:

\[
f(x) = \ln(1 + e^x)
\]

\[
f'(x) = \frac{e^x}{1 + e^x}
\]
Problem 27:

\[ f(x) = (1 + e^x)^{10} \]

\[ f'(x) = ? \]
Problem 27:

\[ f(x) = (1 + e^x)^{10} \]

\[ f'(x) = 10 \cdot (1 + e^x)^9 \cdot e^x \]
Problem 35:

\[ z = \frac{t^2 + 5t + 2}{t + 3} \]

\[ z' = {?} \]
Problem 35:

\[ z = \frac{t^2 + 5t + 2}{t + 3} \]

\[ z' = \]
Problem 35:

\[ z = \frac{t^2 + 5t + 2}{t + 3} \]

\[ z' = \frac{(t + 3)^2}{(t + 3)^2} \]
Problem 35:

\[ z = \frac{t^2 + 5t + 2}{t + 3} \]

\[ z' = \frac{(t + 3) \cdot (2t + 5) - (t^2 + 5t + 2) \cdot 1}{(t + 3)^2} \]
Problem 35:

\[ z = \frac{t^2 + 5t + 2}{t + 3} \]

\[ z' = \frac{(t + 3) \cdot (2t + 5) - (t^2 + 5t + 2) \cdot 1}{(t + 3)^2} \]
Problem 35:

\[ z = \frac{t^2 + 5t + 2}{t + 3} \]

\[ z' = \frac{(t + 3) \cdot (2t + 5) - (t^2 + 5t + 2) \cdot 1}{(t + 3)^2} \]
Problem 35:

\[ z = \frac{t^2 + 5t + 2}{t + 3} \]

\[ z' = \frac{(t + 3) \cdot (2t + 5) - (t^2 + 5t + 2) \cdot 1}{(t + 3)^2} \]
Problem 35:

\[ z = \frac{t^2 + 5t + 2}{t + 3} \]

\[ z' = \frac{(t + 3) \cdot (2t + 5) - (t^2 + 5t + 2) \cdot 1}{(t + 3)^2} \]

\[ = \frac{(t + 3)^2}{(t + 3)^2} \]
Problem 35:

\[ z = \frac{t^2 + 5t + 2}{t + 3} \]

\[ z' = \frac{(t + 3) \cdot (2t + 5) - (t^2 + 5t + 2) \cdot 1}{(t + 3)^2} \]

\[ = \frac{t^2}{(t + 3)^2} \]
Problem 35:

\[ z = \frac{t^2 + 5t + 2}{t + 3} \]

\[ z' = \frac{(t + 3) \cdot (2t + 5) - (t^2 + 5t + 2) \cdot 1}{(t + 3)^2} \]

\[ = \frac{t^2 + 6t}{(t + 3)^2} \]
Problem 35:

\[ z = \frac{t^2 + 5t + 2}{t + 3} \]

\[ z' = \frac{(t + 3) \cdot (2t + 5) - (t^2 + 5t + 2) \cdot 1}{(t + 3)^2} \]

\[ = \frac{t^2 + 6t + 13}{(t + 3)^2} \]
Problem 37:

\[ f(x) = 2x^3 - 5x^2 + 3x - 5 \]

Find the equation of the tangent line at \( x = 1 \).
Problem 37:

\[ f(x) = 2x^3 - 5x^2 + 3x - 5 \]

Find the equation of the tangent line at \( x = 1 \).

\[ f'(x) = 6x^2 - 10x + 3 \]
Problem 37:

\[ f(x) = 2x^3 - 5x^2 + 3x - 5 \]

Find the equation of the tangent line at \( x = 1 \).

\[ f'(x) = 6x^2 - 10x + 3 \]

The slope at \( x = 1 \) is \( f'(1) = -1 \).
Problem 37:

\[ f(x) = 2x^3 - 5x^2 + 3x - 5 \]

Find the equation of the tangent line at \( x = 1 \).

\[ f'(x) = 6x^2 - 10x + 3 \]

The slope at \( x = 1 \) is \( f'(1) = -1 \).

\[ y = -x + b \]
Problem 37:

\[ f(x) = 2x^3 - 5x^2 + 3x - 5 \]

Find the equation of the tangent line at \( x = 1 \).

\[ f'(x) = 6x^2 - 10x + 3 \]

The slope at \( x = 1 \) is \( f'(1) = -1 \).

\[-5 = -1 + b\]
Problem 37:

\[ f(x) = 2x^3 - 5x^2 + 3x - 5 \]

Find the equation of the tangent line at \( x = 1 \).

\[ f'(x) = 6x^2 - 10x + 3 \]

The slope at \( x = 1 \) is \( f'(1) = -1 \).

\[-5 = -1 + b\]
Problem 37:

\[ f(x) = 2x^3 - 5x^2 + 3x - 5 \]

Find the equation of the tangent line at \( x = 1 \).

\[ f'(x) = 6x^2 - 10x + 3 \]

The slope at \( x = 1 \) is \( f'(1) = -1 \).

\[ b = -4 \]
Problem 37:

\[ f(x) = 2x^3 - 5x^2 + 3x - 5 \]

Find the equation of the tangent line at \( x = 1 \).

\[ f'(x) = 6x^2 - 10x + 3 \]

The slope at \( x = 1 \) is \( f'(1) = -1 \).

\[ y = -x - 4 \]
Problem 42:

\[ P(t) = 10e^{0.6t} \] fish where \( t \) is in months

\[ P(12) = ? \quad P'(12) = ? \]
Problem 42:

\[ P(t) = 10e^{0.6t} \] fish where \( t \) is in months

\[ P(12) = ? \quad P'(12) = ? \]

\[ P(12) = 10e^{0.6 \cdot 12} \]
Problem 42:

\[ P(t) = 10e^{0.6t} \] fish where \( t \) is in months

\[ P(12) = ? \quad P'(12) = ? \]

\[ P(12) = 10e^{0.6 \cdot 12} = 10e^{7.2} \]
Problem 42:

\[ P(t) = 10e^{0.6t} \text{ fish where } t \text{ is in months} \]

\[ P(12) = ? \quad P'(12) = ? \]

\[ P(12) = 10e^{0.6 \cdot 12} = 10e^{7.2} = 13394.3 \]
Problem 42:

\[ P(t) = 10e^{0.6t} \text{ fish where } t \text{ is in months} \]

\[ P(12) = ? \quad P'(12) = ? \]

\[ P(12) = 10e^{0.6 \cdot 12} = 10e^{7.2} = 13394.3 \]

In one year, there will be 13394.3 fish.
Problem 42:

\[ P(t) = 10e^{0.6t} \] fish where \( t \) is in months

\[ P(12) = ? \quad P'(12) = ? \]

\[ P(12) = 10e^{0.6 \cdot 12} = 10e^{7.2} = 13394.3 \]

In one year, there will be \( \approx 13394 \) fish.
Problem 42:

\[ P(t) = 10e^{0.6t} \] fish where \( t \) is in months

\[ P(12) = ? \quad P'(12) = ? \]

\[ P'(t) = 10e^{0.6t} \cdot 0.6 \]
Problem 42:

\[ P(t) = 10e^{0.6t} \] fish where \( t \) is in months

\[ P(12) = ? \quad P'(12) = ? \]

\[ P'(t) = 10e^{0.6t} \cdot 0.6 \quad P'(12) = P(12) \cdot 0.6 \]
Problem 42:

\[ P(t) = 10e^{0.6t} \text{ fish where } t \text{ is in months} \]

\[ P(12) = ? \quad P'(12) = ? \]

\[ P'(t) = 10e^{0.6t} \cdot 0.6 \quad P'(12) = 13394 \cdot 0.6 \]
Problem 42:

\[ P(t) = 10e^{0.6t} \text{ fish where } t \text{ is in months} \]

\[ P(12) = ? \quad P'(12) = ? \]

\[ P'(t) = 10e^{0.6t} \cdot 0.6 \quad P'(12) = 8036 \]
Problem 42:

\[ P(t) = 10e^{0.6t} \text{ fish where } t \text{ is in months} \]

\[ P(12) = ? \quad P'(12) = ? \]

\[ P'(t) = 10e^{0.6t} \cdot 0.6 \quad P'(12) = 8036 \]

In the first month after the first year, the fish population will increase by approximately 8036 fish.
Problem 42:

\[ P(t) = 10e^{0.6t} \] fish where \( t \) is in months

\[ P(12) = ? \quad P'(12) = ? \]

\[ P'(t) = 10e^{0.6t} \cdot 0.6 \quad P'(12) = 8037 \]

In the first month after the first year, the fish population will increase by approximately \( 8037 \) fish.
Problem 42:

\[ P(t) = 10e^{0.6t} \text{ fish where } t \text{ is in months} \]

\[ P(12) = 13394 \quad P'(12) = 8037 \]

What are the units?
Problem 42:

\[ P(t) = 10e^{0.6t} \] fish where \( t \) is in months

\[ P(12) = 13394 \quad P'(12) = 8037 \]

fish \quad fish/month
Problem 44:

\[ f(t) = 100te^{-0.5t} \text{ mg where } t \text{ is in hours} \]

Compute \( f(1), f'(1), f(5), \text{ and } f'(5). \)
Problem 44:

\[ f(t) = 100te^{-0.5t} \text{ mg where } t \text{ is in hours} \]

Compute \( f(1) \), \( f'(1) \), \( f(5) \), and \( f'(5) \).

\[ f(1) = 100e^{-0.5} = 60.653\ldots \]
Problem 44:

\[ f(t) = 100te^{-0.5t} \text{ mg where } t \text{ is in hours} \]

Compute \( f(1) \), \( f'(1) \), \( f(5) \), and \( f'(5) \).

\[ f(1) = 100e^{-0.5} = 60.653\ldots \text{ mg} \]
Problem 44:

\[ f(t) = 100te^{-0.5t} \text{ mg where } t \text{ is in hours} \]

Compute \( f(1) \), \( f'(1) \), \( f(5) \), and \( f'(5) \).

\[ f(1) = 100e^{-0.5} = 60.653\ldots \text{ mg} \]

One hour after the injection of the drug, about 61 milligrams of the drug are in the body.
Problem 44:

\[ f(t) = 100te^{-0.5t} \text{ mg where } t \text{ is in hours} \]

Compute \( f(1), f'(1), f(5), \) and \( f'(5). \)

\[ f(5) = 500e^{-2.5} = 41.04\ldots \text{ mg} \]

Five hours after the injection of the drug, about 41 milligrams of the drug are in the body.
Problem 44:

\[ f(t) = 100te^{-0.5t} \text{ mg where } t \text{ is in hours} \]

Compute \( f(1), f'(1), f(5), \) and \( f'(5). \)

\[ f'(t) = \]
Problem 44:

\[ f(t) = 100te^{-0.5t} \text{ mg where } t \text{ is in hours} \]

Compute \( f(1), f'(1), f(5), \) and \( f'(5). \)

\[ f'(t) = 100 \cdot ( \quad ) \]
Problem 44:

\[ f(t) = 100te^{-0.5t} \text{ mg where } t \text{ is in hours} \]

Compute \( f(1), f'(1), f(5), \) and \( f'(5). \)

\[ f'(t) = 100 \cdot (1 \cdot e^{-0.5t} + t \cdot e^{-0.5t} \cdot (-0.5)) \]
Problem 44:

\[ f(t) = 100te^{-0.5t} \text{ mg where } t \text{ is in hours} \]

Compute \( f(1), f'(1), f(5), \) and \( f'(5). \)

\[ f'(t) = 100 \cdot (1 \cdot e^{-0.5t} + t \cdot e^{-0.5t} \cdot (-0.5)) \]
\[ = 100(1 - 0.5t)e^{-0.5t} \]
Problem 44:

\[ f(t) = 100te^{-0.5t} \text{ mg where } t \text{ is in hours} \]

Compute \( f(1), f'(1), f(5), \) and \( f'(5). \)

\[ f'(t) = 100(1 - 0.5t)e^{-0.5t} \]
Problem 44:

\[ f(t) = 100te^{-0.5t} \text{ mg where } t \text{ is in hours} \]

Compute \( f(1) \), \( f'(1) \), \( f(5) \), and \( f'(5) \).

\[ f'(t) = 100(1 - 0.5t)e^{-0.5t} \]

\[ f'(1) = 50e^{-0.5} \approx 30.33 \text{ mg/hour} \]
Problem 44:

\[ f(t) = 100te^{-0.5t} \text{ mg where } t \text{ is in hours} \]

Compute \( f(1), f'(1), f(5), \) and \( f'(5). \)

\[ f'(t) = 100(1 - 0.5t)e^{-0.5t} \]

\[ f'(1) = 50e^{-0.5} \approx 30.33 \text{ mg/hour} \]

After one hour, the drug is entering the body at a rate of 30 milligrams per hour.
Problem 44:

\[ f(t) = 100te^{-0.5t} \text{ mg where } t \text{ is in hours} \]

Compute \( f(1), f'(1), f(5), \) and \( f'(5). \)

\[ f'(t) = 100(1 - 0.5t)e^{-0.5t} \]

\[ f'(5) = -150e^{-2.5} \approx -12.31 \text{ mg/hour} \]

After five hours, the drug is leaving the body at a rate of 12 milligrams per hour.
Problem 45:

\[ r(2) = 4, \quad s(2) = 1, \quad s(4) = 2, \]
\[ r'(2) = -1, \quad s'(2) = 3, \quad s'(4) = 3 \]
Problem 45:

\[ r(2) = 4, \quad s(2) = 1, \quad s(4) = 2, \]
\[ r'(2) = -1, \quad s'(2) = 3, \quad s'(4) = 3 \]

(a) \( H'(2) = \square \) where \( H(x) = r(x) + s(x) \)
Problem 45:

\[ r(2) = 4, \quad s(2) = 1, \quad s(4) = 2, \]
\[ r'(2) = -1, \quad s'(2) = 3, \quad s'(4) = 3 \]

(a) \( H'(2) = \) where \( H(x) = r(x) + s(x) \)

\[ H'(x) = r'(x) + s'(x) \]
Problem 45:

\[ r(2) = 4, \quad s(2) = 1, \quad s(4) = 2, \]
\[ r'(2) = -1, \quad s'(2) = 3, \quad s'(4) = 3 \]

(a) \( H'(2) = \square \) where \( H(x) = r(x) + s(x) \)

\[ H'(x) = r'(x) + s'(x) \]
\[ H'(2) = r'(2) + s'(2) \]
Problem 45:

\[ r(2) = 4, \quad s(2) = 1, \quad s(4) = 2, \]
\[ r'(2) = -1, \quad s'(2) = 3, \quad s'(4) = 3 \]

(a) \( H'(2) = \square \) where \( H(x) = r(x) + s(x) \)

\[ H'(x) = r'(x) + s'(x) \]
\[ H'(2) = r'(2) + s'(2) \]
\[ = -1 + 3 \]
Problem 45:

\[ r(2) = 4, \quad s(2) = 1, \quad s(4) = 2, \]
\[ r'(2) = -1, \quad s'(2) = 3, \quad s'(4) = 3 \]

(a) \( H'(2) = \square \) where \( H(x) = r(x) + s(x) \)

\[ H'(x) = r'(x) + s'(x) \]
\[ H'(2) = r'(2) + s'(2) \]
\[ = -1 + 3 = 2 \]
Problem 45:

\[ r(2) = 4, \quad s(2) = 1, \quad s(4) = 2, \]
\[ r'(2) = -1, \quad s'(2) = 3, \quad s'(4) = 3 \]

(a) \[ H'(2) = \boxed{2} \] where \[ H(x) = r(x) + s(x) \]

\[ H'(x) = r'(x) + s'(x) \]
\[ H'(2) = r'(2) + s'(2) \]
\[ = -1 + 3 = 2 \]
Problem 45:

\[ r(2) = 4, \quad s(2) = 1, \quad s(4) = 2, \]
\[ r'(2) = -1, \quad s'(2) = 3, \quad s'(4) = 3 \]

(b) \[ H'(2) = \square \text{ where } H(x) = 5s(x) \]
Problem 45:

\[ r(2) = 4, \quad s(2) = 1, \quad s(4) = 2, \]
\[ r'(2) = -1, \quad s'(2) = 3, \quad s'(4) = 3 \]

(b) \( H'(2) = \square \) where \( H(x) = 5s(x) \)

\[ H'(x) = 5s'(x) \]
Problem 45:

\[ r(2) = 4, \quad s(2) = 1, \quad s(4) = 2, \]
\[ r'(2) = -1, \quad s'(2) = 3, \quad s'(4) = 3 \]

(b) \( H'(2) = \boxed{\text{}} \) where \( H(x) = 5s(x) \)

\[ H'(x) = 5s'(x) \]
\[ H'(2) = 5s'(2) \]
Problem 45:

\[ r(2) = 4, \quad s(2) = 1, \quad s(4) = 2, \]
\[ r'(2) = -1, \quad s'(2) = 3, \quad s'(4) = 3 \]

(b) \( H'(2) = \square \) where \( H(x) = 5s(x) \)

\[ H'(x) = 5s'(x) \]
\[ H'(2) = 5s'(2) \]
\[ = 5 \cdot 3 = 15 \]
Problem 45:

\[ r(2) = 4, \quad s(2) = 1, \quad s(4) = 2, \]
\[ r'(2) = -1, \quad s'(2) = 3, \quad s'(4) = 3 \]

(b) \( H'(2) = 15 \) where \( H(x) = 5s(x) \)

\[ H'(x) = 5s'(x) \]
\[ H'(2) = 5s'(2) \]
\[ = 5 \cdot 3 = 15 \]
Problem 45:

\[ r(2) = 4, \quad s(2) = 1, \quad s(4) = 2, \]
\[ r'(2) = -1, \quad s'(2) = 3, \quad s'(4) = 3 \]

(c) \[ H'(2) = \square \] where \[ H(x) = r(x) \cdot s(x) \]
Problem 45:

\[ r(2) = 4, \quad s(2) = 1, \quad s(4) = 2, \]
\[ r'(2) = -1, \quad s'(2) = 3, \quad s'(4) = 3 \]

(c) \[ H'(2) = \square \] where \( H(x) = r(x) \cdot s(x) \)

\[ H'(x) = r'(x)s(x) + r(x)s'(x) \]
Problem 45:

\[ r(2) = 4, \quad s(2) = 1, \quad s(4) = 2, \]
\[ r'(2) = -1, \quad s'(2) = 3, \quad s'(4) = 3 \]

(c) \( H'(2) = \square \) where \( H(x) = r(x) \cdot s(x) \)

\[ H'(x) = r'(x)s(x) + r(x)s'(x) \]
\[ H'(2) = r'(2)s(2) + r(2)s'(2) \]
Problem 45:

\[ r(2) = 4, \quad s(2) = 1, \quad s(4) = 2, \]
\[ r'(2) = -1, \quad s'(2) = 3, \quad s'(4) = 3 \]

(c) \( H'(2) = \) where \( H(x) = r(x) \cdot s(x) \)

\[
H'(x) = r'(x)s(x) + r(x)s'(x)
\]
\[
H'(2) = r'(2)s(2) + r(2)s'(2) = (-1) \cdot 1 + 4 \cdot 3 = 11
\]
Problem 45:

\[ r(2) = 4, \quad s(2) = 1, \quad s(4) = 2, \]
\[ r'(2) = -1, \quad s'(2) = 3, \quad s'(4) = 3 \]

(c) \( H'(2) = 11 \) where \( H(x) = r(x) \cdot s(x) \)

\[ H'(x) = r'(x)s(x) + r(x)s'(x) \]
\[ H'(2) = r'(2)s(2) + r(2)s'(2) \]
\[ = (-1) \cdot 1 + 4 \cdot 3 = 11 \]
Problem 45:

\[ r(2) = 4, \quad s(2) = 1, \quad s(4) = 2, \]
\[ r'(2) = -1, \quad s'(2) = 3, \quad s'(4) = 3 \]

(d) \( H'(2) = \underline{\text{?}} \) where \( H(x) = \sqrt{r(x)} \)
Problem 45:

\[ r(2) = 4, \quad s(2) = 1, \quad s(4) = 2, \]
\[ r'(2) = -1, \quad s'(2) = 3, \quad s'(4) = 3 \]

(d) \( H'(2) = \underline{\quad} \) where \( H(x) = \sqrt{r(x)} \)

\[ H'(x) = \frac{1}{2}r(x)^{-1/2}r'(x) \]
Problem 45:

\[ r(2) = 4, \quad s(2) = 1, \quad s(4) = 2, \]
\[ r'(2) = -1, \quad s'(2) = 3, \quad s'(4) = 3 \]

(d) \( H'(2) = \boxed{\_\_\_\_\_\_} \) where \( H(x) = \sqrt{r(x)} \)

\[ H'(x) = (1/2) r(x)^{-1/2} r'(x) \]
\[ H'(2) = (1/2) r(2)^{-1/2} r'(2) \]
Problem 45:

\[ r(2) = 4, \quad s(2) = 1, \quad s(4) = 2, \]
\[ r'(2) = -1, \quad s'(2) = 3, \quad s'(4) = 3 \]

(d) \( H'(2) = \square \) where \( H(x) = \sqrt{r(x)} \)

\[ H'(x) = \frac{1}{2} r(x)^{-1/2} r'(x) \]
\[ H'(2) = \frac{1}{2} r(2)^{-1/2} r'(2) \]
\[ = \frac{1}{2} 4^{-1/2} (-1) \]
Problem 45:

\[ r(2) = 4, \quad s(2) = 1, \quad s(4) = 2, \]
\[ r'(2) = -1, \quad s'(2) = 3, \quad s'(4) = 3 \]

(d) \( H'(2) = \boxed{} \) where \( H(x) = \sqrt{r(x)} \)

\[ H'(x) = \left(\frac{1}{2}\right) r(x)^{-1/2} r'(x) \]
\[ H'(2) = \left(\frac{1}{2}\right) r(2)^{-1/2} r'(2) \]
\[ = \left(\frac{1}{2}\right) 4^{-1/2} (-1) = -1/4 \]
Problem 45:

\[ r(2) = 4, \quad s(2) = 1, \quad s(4) = 2, \]
\[ r'(2) = -1, \quad s'(2) = 3, \quad s'(4) = 3 \]

(d) \[ H'(2) = -\frac{1}{4} \] where \[ H(x) = \sqrt{r(x)} \]

\[ H'(x) = \frac{1}{2} r(x)^{-1/2} r'(x) \]

\[ H'(2) = \frac{1}{2} r(2)^{-1/2} r'(2) \]
\[ = \frac{1}{2} 4^{-1/2} (-1) = -\frac{1}{4} \]
Problem 49:

\[ f(x) = x^4 - 4x^3 \]

Where am I both decreasing and concave up?
Problem 49:

\[ f(x) = x^4 - 4x^3 \]

Where am I both decreasing and concave up?

\[ f'(x) = \]
Problem 49:

\[ f(x) = x^4 - 4x^3 \]

Where am I both decreasing and concave up?

\[ f'(x) = 4x^3 - 12x^2 \]
Problem 49:

\[ f(x) = x^4 - 4x^3 \]

Where am I both decreasing and concave up?

\[ f'(x) = 4x^3 - 12x^2 = 4x^2(x - 3) \]
Problem 49:

\[ f(x) = x^4 - 4x^3 \]

Where am I both decreasing and concave up?

\[ f'(x) = 4x^3 - 12x^2 = 4x^2(x - 3) \]

\[ f(x) \text{ is decreasing for} \]
Problem 49:

\[ f(x) = x^4 - 4x^3 \]

Where am I both decreasing and concave up?

\[ f'(x) = 4x^3 - 12x^2 = 4x^2(x - 3) \]

\[ f(x) \text{ is decreasing for } x < 3 \]
Problem 49:

\[ f(x) = x^4 - 4x^3 \]

Where am I both decreasing and concave up?

\[ f(x) \text{ is decreasing for } x < 3 \]

\[ f''(x) = \]
Problem 49:

\[ f(x) = x^4 - 4x^3 \]

Where am I both decreasing and concave up?

\[ f(x) \text{ is decreasing for } x < 3 \]

\[ f''(x) = 12x^2 - 24x \]
Problem 49:

\[ f(x) = x^4 - 4x^3 \]

Where am I both decreasing and concave up?

\[ f(x) \text{ is decreasing for } x < 3 \]

\[ f''(x) = 12x^2 - 24x = 12x(x - 2) \]
Problem 49:

\[ f(x) = x^4 - 4x^3 \]

Where am I both decreasing and concave up?

\[ f(x) \text{ is decreasing for } x < 3 \]

\[ f''(x) = 12x^2 - 24x = 12x(x - 2) \]

\[ f(x) \text{ is concave up for} \]
Problem 49:

\[ f(x) = x^4 - 4x^3 \]

Where am I both decreasing and concave up?

\[ f(x) \] is decreasing for \( x < 3 \)

\[ f''(x) = 12x^2 - 24x = 12x(x - 2) \]

\( f(x) \) is concave up for \( x < 0 \)
Problem 49:

\[ f(x) = x^4 - 4x^3 \]

Where am I both decreasing and concave up?

\[ f(x) \text{ is decreasing for } x < 3 \]

\[ f''(x) = 12x^2 - 24x = 12x(x - 2) \]

\[ f(x) \text{ is concave up for } x < 0 \text{ and } x > 2 \]
Problem 49:

\[ f(x) = x^4 - 4x^3 \]

Where am I both decreasing and concave up?

\[ f(x) \text{ is decreasing for } x < 3 \]

\[ f(x) \text{ is concave up for } x < 0 \text{ and } x > 2 \]
Problem 49:

\[ f(x) = x^4 - 4x^3 \]

Where am I both decreasing and concave up?

\( f(x) \) is decreasing for \( x < 3 \)

\( f(x) \) is concave up for \( x < 0 \) and \( x > 2 \)

\( f(x) \) is both decreasing and concave up for
Problem 49:

\[ f(x) = x^4 - 4x^3 \]

Where am I both decreasing and concave up?

\( f(x) \) is decreasing for \( x < 3 \)

\( f(x) \) is concave up for \( x < 0 \) and \( x > 2 \)

\( f(x) \) is both decreasing and concave up for \( x < 0 \) and \( 2 < x < 3 \)
PROBLEMS FROM PAGE 213
Problem 4:

\[ f(x) = x^3 - 3x^2 \quad (-1 \leq x \leq 3) \]

Find \( f' \) and \( f'' \).
Problem 4:

\[ f(x) = x^3 - 3x^2 \quad (-1 \leq x \leq 3) \]

Find \( f' \) and \( f'' \).

\[ f'(x) = 3x^2 - 6x \]
Problem 4:

\[ f(x) = x^3 - 3x^2 \quad (-1 \leq x \leq 3) \]

Find \( f' \) and \( f'' \).

\[ f'(x) = 3x^2 - 6x \]
\[ f''(x) = 6x - 6 \]
Problem 4:

\[ f(x) = x^3 - 3x^2 \quad (-1 \leq x \leq 3) \]

Find the critical points of \( f \).

\[ f'(x) = 3x^2 - 6x \]

\[ f''(x) = 6x - 6 \]
Problem 4:

\[ f(x) = x^3 - 3x^2 \quad (-1 \leq x \leq 3) \]

Find the critical points of \( f \).

\[ f'(x) = 3x^2 - 6x = 3x(x - 2) \]
\[ f''(x) = 6x - 6 \]
Problem 4:

\[ f(x) = x^3 - 3x^2 \quad (-1 \leq x \leq 3) \]

Find the critical points of \( f \).

\[ f'(x) = 3x^2 - 6x = 3x(x - 2) \]

\[ f''(x) = 6x - 6 \]

The critical points are at \( x = 0 \) and \( x = 2 \).
Problem 4:

\[ f(x) = x^3 - 3x^2 \quad (-1 \leq x \leq 3) \]

Find the critical points of \( f \).

\[ f'(x) = 3x^2 - 6x = 3x(x - 2) \]
\[ f''(x) = 6x - 6 \]

The critical points are at \( x = 0 \) and \( x = 2 \).
Problem 4:

\[ f(x) = x^3 - 3x^2 \quad (-1 \leq x \leq 3) \]

Find the inflection points of \( f \).

\[ f'(x) = 3x^2 - 6x = 3x(x - 2) \]
\[ f''(x) = 6x - 6 \]
Problem 4:

\[ f(x) = x^3 - 3x^2 \quad (-1 \leq x \leq 3) \]

Find the inflection points of \( f \).

\[ f'(x) = 3x^2 - 6x = 3x(x - 2) \]
\[ f''(x) = 6x - 6 = 6(x - 1) \]
Problem 4:

\[ f(x) = x^3 - 3x^2 \quad (-1 \leq x \leq 3) \]

Find the inflection points of \( f \).

\[ f'(x) = 3x^2 - 6x = 3x(x - 2) \]

\[ f''(x) = 6x - 6 = 6(x - 1) \]

The only inflection point of \( f \) is at \( x = 1 \).
Problem 4:

\[ f(x) = x^3 - 3x^2 \quad (-1 \leq x \leq 3) \]

Find the inflection points of \( f \).

\[ f'(x) = 3x^2 - 6x = 3x(x - 2) \]
\[ f''(x) = 6x - 6 = 6(x - 1) \]

The only inflection point of \( f \) is at \( x = 1 \).

Or is it?
Problem 4:

\[ f(x) = x^3 - 3x^2 \quad (-1 \leq x \leq 3) \]

Find the inflection points of \( f \).

\[ f'(x) = 3x^2 - 6x = 3x(x - 2) \]

\[ f''(x) = 6x - 6 = 6(x - 1) \]

The only inflection point of \( f \) is at \( x = 1 \).

Or is it? Yes.
Problem 4:

\[ f(x) = x^3 - 3x^2 \quad (-1 \leq x \leq 3) \]

What are the local max and local min?
Problem 4:

\[ f(x) = x^3 - 3x^2 \quad (-1 \leq x \leq 3) \]

What are the local max and local min?

\[ f'(x) = 3x(x - 2) \quad f''(x) = 6(x - 1) \]
Problem 4:

\[ f(x) = x^3 - 3x^2 \quad (-1 \leq x \leq 3) \]

What are the local max and local min?

\[ f'(x) = 3x(x - 2) \quad f''(x) = 6(x - 1) \]

The graph is concaved down and then up.
Problem 4:

\[ f(x) = x^3 - 3x^2 \quad (-1 \leq x \leq 3) \]

What are the local max and local min?

\[ f'(x) = 3x(x - 2) \quad f''(x) = 6(x - 1) \]

The graph is concaved down and then up.

It has local maxima at \( x = 0 \) and \( x = 3 \).
Problem 4:

\[ f(x) = x^3 - 3x^2 \quad (-1 \leq x \leq 3) \]

What are the local max and local min?

\[ f'(x) = 3x(x - 2) \quad f''(x) = 6(x - 1) \]

The graph is concaved down and then up.

It has local maxima at \( x = 0 \) and \( x = 3 \).
It has local minima at \( x = -1 \) and \( x = 2 \).
Problem 7:

\[ f(x) = 2x^3 - 9x^2 + 12x + 1 \quad (-0.5 \leq x \leq 3) \]

Find \( f' \) and \( f'' \).
Problem 7:

\[ f(x) = 2x^3 - 9x^2 + 12x + 1 \quad (-0.5 \leq x \leq 3) \]

Find \( f' \) and \( f'' \).

\[ f'(x) = 6x^2 - 18x + 12 \]
Problem 7:

\[ f(x) = 2x^3 - 9x^2 + 12x + 1 \quad (-0.5 \leq x \leq 3) \]

Find \( f' \) and \( f'' \).

\[ f'(x) = 6x^2 - 18x + 12 \]
\[ f''(x) = 12x - 18 \]
Problem 7:

\[ f(x) = 2x^3 - 9x^2 + 12x + 1 \quad (-0.5 \leq x \leq 3) \]

Find the critical points of \( f \).

\[ f'(x) = 6x^2 - 18x + 12 \]
\[ f''(x) = 12x - 18 \]
Problem 7:

\[ f(x) = 2x^3 - 9x^2 + 12x + 1 \quad (-0.5 \leq x \leq 3) \]

Find the critical points of \( f \).

\[ f'(x) = 6x^2 - 18x + 12 = 6(x - 1)(x - 2) \]

\[ f''(x) = 12x - 18 \]
Problem 7:

\[ f(x) = 2x^3 - 9x^2 + 12x + 1 \quad (-0.5 \leq x \leq 3) \]

Find the critical points of \( f \).

\[ f'(x) = 6x^2 - 18x + 12 = 6(x - 1)(x - 2) \]

\[ f''(x) = 12x - 18 \]

The critical points are at \( x = 1 \) and \( x = 2 \).
Problem 7:

\[ f(x) = 2x^3 - 9x^2 + 12x + 1 \quad (-0.5 \leq x \leq 3) \]

Find the critical points of \( f \).

\[ f'(x) = 6x^2 - 18x + 12 = 6(x - 1)(x - 2) \]

\[ f''(x) = 12x - 18 \]

The critical points are at \( x = 1 \) and \( x = 2 \).
Problem 7:

\[ f(x) = 2x^3 - 9x^2 + 12x + 1 \quad (-0.5 \leq x \leq 3) \]

Find the inflection points of \( f \).

\[ f'(x) = 6x^2 - 18x + 12 = 6(x - 1)(x - 2) \]
\[ f''(x) = 12x - 18 \]
Problem 7:

\[ f(x) = 2x^3 - 9x^2 + 12x + 1 \quad (-0.5 \leq x \leq 3) \]

Find the inflection points of \( f \).

\[ f'(x) = 6x^2 - 18x + 12 = 6(x - 1)(x - 2) \]

\[ f''(x) = 12x - 18 = 6(2x - 3) \]
Problem 7:

\[ f(x) = 2x^3 - 9x^2 + 12x + 1 \quad (-0.5 \leq x \leq 3) \]

Find the inflection points of \( f \).

\[
\begin{align*}
  f'(x) &= 6x^2 - 18x + 12 = 6(x - 1)(x - 2) \\
  f''(x) &= 12x - 18 = 6(2x - 3)
\end{align*}
\]

The only inflection point of \( f \) is at \( x = 3/2 \).
Problem 7:

\[ f(x) = 2x^3 - 9x^2 + 12x + 1 \quad (-0.5 \leq x \leq 3) \]

Find the inflection points of \( f \).

\[ f'(x) = 6x^2 - 18x + 12 = 6(x - 1)(x - 2) \]
\[ f''(x) = 12x - 18 = 6(2x - 3) \]

The only inflection point of \( f \) is at \( x = 3/2 \).

Or is it?
Problem 7:

\[ f(x) = 2x^3 - 9x^2 + 12x + 1 \text{ (}-0.5 \leq x \leq 3\) \]

Find the inflection points of \( f \).

\[ f'(x) = 6x^2 - 18x + 12 = 6(x - 1)(x - 2) \]

\[ f''(x) = 12x - 18 = 6(2x - 3) \]

The only inflection point of \( f \) is at \( x = \frac{3}{2} \).

Or is it? Yes.
Problem 7:

\[ f(x) = 2x^3 - 9x^2 + 12x + 1 \quad (-0.5 \leq x \leq 3) \]

What are the local max and local min?
Problem 7:

\[ f(x) = 2x^3 - 9x^2 + 12x + 1 \quad (-0.5 \leq x \leq 3) \]

What are the local max and local min?

\[ f'(x) = 6(x - 1)(x - 2) \quad f''(x) = 6(2x - 3) \]
Problem 7:

\[ f(x) = 2x^3 - 9x^2 + 12x + 1 \quad (-0.5 \leq x \leq 3) \]

What are the local max and local min?

\[ f'(x) = 6(x - 1)(x - 2) \quad f''(x) = 6(2x - 3) \]

The graph is concaved down and then up.
Problem 7:

\[ f(x) = 2x^3 - 9x^2 + 12x + 1 \quad (-0.5 \leq x \leq 3) \]

What are the local max and local min?

\[ f'(x) = 6(x - 1)(x - 2) \quad f''(x) = 6(2x - 3) \]

The graph is concaved down and then up.

It has local maxima at \( x = 1 \) and \( x = 3 \).
Problem 7:

\[ f(x) = 2x^3 - 9x^2 + 12x + 1 \quad (-0.5 \leq x \leq 3) \]

What are the local max and local min?

\[ f'(x) = 6(x - 1)(x - 2) \quad f''(x) = 6(2x - 3) \]

The graph is concaved down and then up.

It has local maxima at \( x = 1 \) and \( x = 3 \).

It has local minima at \( x = -0.5 \) and \( x = 2 \).
Problem 8:

\[ f(x) = x^3 - 3x^2 - 9x + 15 \quad (-5 \leq x \leq 4) \]

Find \( f' \) and \( f'' \).
Problem 8:

\[ f(x) = x^3 - 3x^2 - 9x + 15 \quad (-5 \leq x \leq 4) \]

Find \( f' \) and \( f'' \).

\[ f'(x) = 3x^2 - 6x - 9 \]
Problem 8:

\[ f(x) = x^3 - 3x^2 - 9x + 15 \quad (-5 \leq x \leq 4) \]

Find \( f' \) and \( f'' \).

\[ f'(x) = 3x^2 - 6x - 9 \]
\[ f''(x) = 6x - 6 \]
Problem 8:

\[ f(x) = x^3 - 3x^2 - 9x + 15 \quad (-5 \leq x \leq 4) \]

Find the critical points of \( f \).

\[ f'(x) = 3x^2 - 6x - 9 \]
\[ f''(x) = 6x - 6 \]
Problem 8:

\[ f(x) = x^3 - 3x^2 - 9x + 15 \quad (-5 \leq x \leq 4) \]

Find the critical points of \( f \).

\[ f'(x) = 3x^2 - 6x - 9 = 3(x + 1)(x - 3) \]

\[ f''(x) = 6x - 6 \]
Problem 8:

\[ f(x) = x^3 - 3x^2 - 9x + 15 \quad (-5 \leq x \leq 4) \]

Find the critical points of \( f \).

\[ f'(x) = 3x^2 - 6x - 9 = 3(x + 1)(x - 3) \]

\[ f''(x) = 6x - 6 \]

The critical points are at \( x = -1 \) and \( x = 3 \).
Problem 8:

\[ f(x) = x^3 - 3x^2 - 9x + 15 \quad (-5 \leq x \leq 4) \]

Find the critical points of \( f \).

\[ f'(x) = 3x^2 - 6x - 9 = 3(x + 1)(x - 3) \]

\[ f''(x) = 6x - 6 \]

The critical points are at \( x = -1 \) and \( x = 3 \).
Problem 8:

\[ f(x) = x^3 - 3x^2 - 9x + 15 \quad (-5 \leq x \leq 4) \]

Find the inflection points of \( f \).

\[ f'(x) = 3x^2 - 6x - 9 = 3(x + 1)(x - 3) \]
\[ f''(x) = 6x - 6 \]
Problem 8:

\[ f(x) = x^3 - 3x^2 - 9x + 15 \quad (-5 \leq x \leq 4) \]

Find the inflection points of \( f \).

\[ f'(x) = 3x^2 - 6x - 9 = 3(x + 1)(x - 3) \]

\[ f''(x) = 6x - 6 = 6(x - 1) \]
Problem 8:

\[ f(x) = x^3 - 3x^2 - 9x + 15 \quad (-5 \leq x \leq 4) \]

Find the inflection points of \( f \).

\[ f'(x) = 3x^2 - 6x - 9 = 3(x + 1)(x - 3) \]

\[ f''(x) = 6x - 6 = 6(x - 1) \]

The only inflection point of \( f \) is at \( x = 1 \).
Problem 8:

\[ f(x) = x^3 - 3x^2 - 9x + 15 \quad (-5 \leq x \leq 4) \]

Find the inflection points of \( f \).

\[ f'(x) = 3x^2 - 6x - 9 = 3(x + 1)(x - 3) \]
\[ f''(x) = 6x - 6 = 6(x - 1) \]

The only inflection point of \( f \) is at \( x = 1 \).

Or is it?
Problem 8:

\[ f(x) = x^3 - 3x^2 - 9x + 15 \quad (-5 \leq x \leq 4) \]

Find the inflection points of \( f \).

\[ f'(x) = 3x^2 - 6x - 9 = 3(x + 1)(x - 3) \]
\[ f''(x) = 6x - 6 = 6(x - 1) \]

The only inflection point of \( f \) is at \( x = 1 \).

Or is it? Yes.
Problem 8:

\[ f(x) = x^3 - 3x^2 - 9x + 15 \quad (-5 \leq x \leq 4) \]

What are the local max and local min?
Problem 8:

\[ f(x) = x^3 - 3x^2 - 9x + 15 \quad (-5 \leq x \leq 4) \]

What are the local max and local min?

\[ f'(x) = 3(x + 1)(x - 3) \quad f''(x) = 6(x - 1) \]
Problem 8:

\[ f(x) = x^3 - 3x^2 - 9x + 15 \quad (-5 \leq x \leq 4) \]

What are the local max and local min?

\[ f'(x) = 3(x + 1)(x - 3) \quad f''(x) = 6(x - 1) \]

The graph is concaved down and then up.
Problem 8:

\[ f(x) = x^3 - 3x^2 - 9x + 15 \quad (-5 \leq x \leq 4) \]

What are the local max and local min?

\[ f'(x) = 3(x + 1)(x - 3) \quad f''(x) = 6(x - 1) \]

The graph is concaved down and then up.

It has local maxima at \( x = -1 \) and \( x = 4 \).
Problem 8:

\[ f(x) = x^3 - 3x^2 - 9x + 15 \quad (-5 \leq x \leq 4) \]

What are the local max and local min?

\[ f'(x) = 3(x + 1)(x - 3) \quad f''(x) = 6(x - 1) \]

The graph is concaved down and then up.

It has local maxima at \( x = -1 \) and \( x = 4 \).

It has local minima at \( x = -5 \) and \( x = 3 \).