(2)

Key

Linear Approximation Practice Problems

Use the given information and a linear approximation to approximate the value of the function at c

Linear approximation steps:

i) Find the tangent line equation ii) plug in decimal into linear equation.

1) $f(2) = 8;\ f'(2) = -3;\ c = 2.06$ ← decimal value

point: (2, 8)

slope: $m = -3$

$y - 8 = -3(x-2)$

$y = -3(x-2) + 8$

$y(2.06) = -3(2.06-2) + 8$

$= \boxed{7.82}$

2) $f(-4) = 3;\ f'(-4) = 2;\ c = -3.6$

point: $(-4, 3)$

slope: $m = 2$

$y - 3 = 2(x+4)$

$y = 2(x+4) + 3$

$y(-3.6) = 2(-3.6+4) + 3$

$\boxed{y(-3.6) = 3.8}$

3) $f(-1) = 0;\ f'(-1) = \frac{3}{2};\ c = -1.1$

point: $(-1, 0)$

slope: $m = 3/2$

$y - 0 = \frac{3}{2}(x+1)$

$y(-1.1) = \frac{3}{2}(-1.1+1) = \boxed{-0.15}$

4) $f(5) = \frac{1}{2};\ f'(5) = -3;\ c = 5.2$

point: $(5, 1/2)$

slope: $m = -3$

$y - 1/2 = -3(x-5)$

$y = -3(x-5) + 1/2$

$y(5.2) = -3(5.2-5) + 1/2$

$\boxed{y(5.2) = -0.1}$

Linear approximation steps:

i) Find the tangent line equation using nearest integer

ii) plug in decimal into linear equation.

5) *Given* $f(x) = 2x^3 - 4x + 1$ *Use Linear approximation to approximate* $f(1.02)$

at $x=1$

$f(1) = 2-4+1 = -1$

$f'(x) = 6x^2 - 4$

$f'(1) = 6-4 = 2$

point: $(1,-1)$

slope: $m=2$

$y+1 = 2(x-1)$

$y = 2(x-1)-1$

$y(1.02) = 2(1.02-1)-1$

$\boxed{y(1.02) = -0.96}$

6) *Given* $f(x) = \frac{2x^3-1}{3-x}$ *Use Linear approximation to approximate* $f(1.01)$ ← quotient

at $x=1$

$f(1) = \frac{2-1}{3-1} = \frac{1}{2}$

$f'(x) = \frac{(6x^2)(3-x) - (2x^3-1)(-1)}{(3-x)^2}$

$f'(1) = \frac{6(2) - (1)(-1)}{(3-1)^2} = \frac{13}{4}$

point: $(1, 1/2)$

slope: $m = 13/4$

$y - 1/2 = \frac{13}{4}(x-1)$

$y = \frac{13}{4}(x-1) + 1/2$

$y = \frac{13}{4}(1.01-1) + 1/2 = \boxed{0.5325}$

7) *Given* $f(x) = \sqrt[3]{3x+2}$ *Use Linear approximation to approximate* $f(2.1)$

at $x=2$

$f(x) = (3x+2)^{1/3}$

$f(2) = (3(2)+2)^{1/3} = \sqrt[3]{8} = 2$

$f(x) = (3x+2)^{1/3}$ out: $(\ )^{1/3}$ in: $3x+2$

$f'(x) = \frac{1}{3}(3x+2)^{-2/3} \cdot (3)$

$f'(x) = \frac{1}{(3x+2)^{2/3}}$

$f'(2) = \frac{1}{(3(2)+2)^{2/3}} = \frac{1}{8^{2/3}} = \frac{1}{4}$

point: $(2,2)$ slope: $m = 1/4$

$y - 2 = \frac{1}{4}(x-2)$

$y = \frac{1}{4}(x-2) + 2$

$y(2.1) = \frac{1}{4}(2.1-2) + 2 = \boxed{2.025}$