

Calculus Review Test

SOLUTIONS

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

a) Find the average rate of change (AROC) over the interval $[-3, 2]$

AROC is the "slope" $\frac{f(2) - f(-3)}{2 - (-3)} = \frac{8 - 2}{5} = \frac{6}{5}$

b) Find the instantaneous rate of change (IROC) at the point $(1, 3)$

"IROC is the first derivative" $f'(x) = 3x^2 - 2$ IROC @ $(1, 3)$ $f'(1) = 3(1)^2 - 2 = 1$

2) Find the equation of the line that is tangent to the curve $y = x^2 + 3$ at $x = 2$

Optional: Graph the line and curve, labeling the point of intersection.

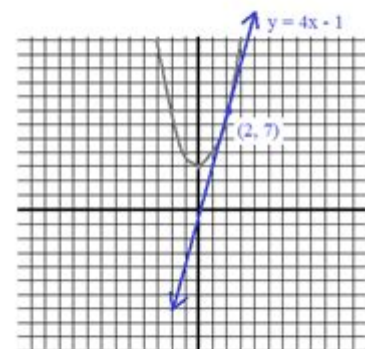
To determine the equation of a line, we need the slope and a point:

Slope: $y' = 2x$ (1st derivative)
at $x = 2$, the slope is 4

Point: $y = x^2 + 3$
at $x = 2$, $y = 7$ $(2, 7)$

equation of the line tangent to the curve: $y - 7 = 4(x - 2)$

or $y = 4x - 1$



3) What is the slope of the normal line of $y = 4x^3$ at point $(2, 32)$?

A normal line is perpendicular to the tangent. $y' = 12x^2$ at $x = 2$, $y' = 48$

Since the slope of the tangent is 48, then the slope of the normal line is $-\frac{1}{48}$

4) Find the limit $\lim_{x \rightarrow 0} \frac{1 - \cos x}{x^2}$

step 2: L'Hospital's Rule

step 1: substitution

$\frac{1 - \cos(0)}{(0)^2} = \frac{0}{0}$ inconclusive

$\frac{0 - (-\sin x)}{2x} = \frac{\sin x}{2x}$

(substitution) $\frac{\sin(0)}{2(0)} = \frac{0}{0}$

(repeat) $\frac{\cos x}{2}$ (substitution)

$\frac{\cos(0)}{2} = \frac{1}{2}$

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