

## Reference 6: Derivative Relationships

### Derivative Relationships on an interval $(a, b)$

	$f$ is positive on $(a, b)$	→	$f$ is increasing on $(a, b)$
	$f$ is negative on $(a, b)$	→	$f$ is decreasing on $(a, b)$
	$f'$ is zero on $(a, b)$	↔	$f$ is constant on $(a, b)$
$f''$ is positive on $(a, b)$	→	→	$f$ is concave up on $(a, b)$
$f''$ is negative on $(a, b)$	→	→	$f$ is concave down on $(a, b)$
$f''$ is zero on $(a, b)$	↔	↔	$f$ is a straight line on $(a, b)$

### Derivative Relationships at a particular $x = c$

	$f'$ is positive at $x = c$	↔	The line tangent to the graph of $f$ at $x = c$ slopes upward.
	$f'$ is negative at $x = c$	↔	The line tangent to the graph of $f$ at $x = c$ slopes downward.
	$f'$ is zero at $x = c$	↔	The line tangent to the graph of $f$ at $x = c$ is horizontal.
$f''$ is positive at $x = c$	↔	→	$f$ is concave up at $x = c$
$f''$ is negative at $x = c$	↔	→	$f$ is concave down at $x = c$
$f''$ is zero at $x = c$	↔	↔	The line tangent to the graph of $f'$ at $x = c$ is horizontal.