Calc Medic Ultimate Justifications Guide

To justify that…	State/show that…
f is continuous at $x = a$	$\lim_{x\to a^-} f(x) = \lim_{x\to a^+} f(x) = L$ $\lim_{x\to a} f(x) = f(a) = L$
f is differentiable at $x = a$	f is continuous at $x = a$ AND $\lim_{x\to a^-} f'(x) = \lim_{x\to a^+} f'(x)$
f is increasing on the interval (a, b)	$f' > 0$ on the interval (a, b)
f is decreasing on the interval (a, b)	$f' < 0$ on the interval (a, b)
f has a critical point at $x = a$	$f'(a) = 0$ or undefined
f has a relative minimum at $x = a$	f' changes from negative to positive at $x = a$
f has a relative maximum at $x = a$	f' changes from positive to negative at $x = a$
f is concave up on the interval (a, b)	$f'' > 0$ on the interval (a, b)
f is concave down on the interval (a, b)	$f'' < 0$ on the interval (a, b)
f has an inflection point at $x = a$	$f''(a) = 0$ or undefined AND f'' changes signs
f has an absolute minimum at $x = a$	f has a critical point at $x = a$ and $f(a)$ has the lowest value of all critical points and endpoints
f has an absolute maximum at $x = a$	f has a critical point at $x = a$ and $f(a)$ has the highest value of all critical points and endpoints

$f(x) = k$ for some x on the interval [a,b]	INTERMEDIATE VALUE THEOREM f is continuous on [a,b] and $f(a) \le k \le f(b)$
$f'(x) = k$ for some x on the interval (a, b)	MEAN VALUE THEOREM f is continuous on [a,b], differentiable on (a,b) and $\frac{f(b)-f(a)}{b-a} = k$
A particle is at rest at $t = k$	$v(k) = 0$ (v is the velocity function)
A particle changes direction at $t = k$	v changes signs at $t = k$ (v is the velocity function)
A particle is speeding up/slowing down at $t = k$	$v(k) =$ _____ $a(k) =$ ______ The particle's velocity and acceleration at $t = k$ have the same/opposite sign.
A particle is moving away from/towards the origin at $t = k$.	$s(k) =$ _____ $v(k) =$ ______ The particle's position and velocity at $t = k$ have the same/opposite sign
A tangent line approximation for $f(a)$ is an underestimate/overestimate for the true value of $f(a)$	f is concave up/ f is concave down near $x = a$
A right Riemann sum is an underapproximation/overapproximation for the area under a curve f between $x = a$ and $x = b$	f is decreasing/f is increasing on the interval (a, b)
A left Riemann sum is an underapproximation/overapproximation for the area under a curve f between $x = a$ and $x = b$	f is increasing/f is decreasing on the interval (a, b)
A trapezoidal approximation is an underapproximation/overapproximation for the area under a curve f between $x = a$ and $x = b$	f is concave down/f is concave up on the interval (a, b)