**Calc Medic Ultimate Justifications Guide**

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| **To justify that…** | **State/show that…** |
| $f$ is continuous at $x=a$ |  |
| $f$ is differentiable at $x=a$ |  |
| $f$ is increasing on the interval $(a,b)$ |  |
| $f$is decreasing on the interval $(a,b)$ |  |
| $f$has a critical point at $x=a$ |  |
| $f$has a relative minimum at $x=a$ |  |
| $f$has a relative maximum at $x=a$ |  |
| $f$is concave up on the interval $(a,b)$ |  |
| $f$ is concave down on the interval $(a,b)$ |  |
| $f$has an inflection point at $x=a$ |  |
| $f$ has an absolute minimum at $x=a$ |  |
| $f$ has an absolute maximum at $x=a$ |  |
| $f\left(x\right)=k$ for some x on the interval [a,b] |  |
| $f^{'}\left(x\right)=k$ for some x on the interval $(a,b)$ |  |
| A particle is at rest at $t=k$ |  |
| A particle changes direction at $t=k$ |  |
| A particle is speeding up/slowing down at $t=k$ |  |
| A particle is moving away from/towards the origin at $t=k$. |  |
| A tangent line approximation for $f(a)$ is an underestimate/overestimate for the true value of $f(a)$ |  |
| A right Riemann sum is an underapproximation/overapproximation for the area under a curve $f$ between $x=a$ and $x=b$ |  |
| A left Riemann sum is an underapproximation/overapproximation for the area under a curve $f$ between $x=a$ and $x=b$ |  |
| A trapezoidal approximation is an underapproximation/overapproximation for the area under a curve $f$ between $x=a$ and $x=b$ |  |