11. **Definition of a Critical Number**: Let f be defined at c.

If $f'(c)=0$ or if f is not differentiable at c, then c is a critical number of f.

12. **The Mean Value Theorem**:

If f is continuous on the interval $[a, b]$ and differentiable on the interval (a, b),

then there exists a number c in (a, b) such that $f'(c)=\frac{f(b)-f(a)}{b-a}$.

13. **Test for Increasing and Decreasing Functions**: Let f be continuous on the interval $[a, b]$.

If $f'(x)>0$ for all x in (a, b), then f is increasing on $[a, b]$.

If $f'(x)<0$ for all x in (a, b), then f is decreasing on $[a, b]$.

14. **The First Derivative Test**:

If $f'(x)$ changes from negative to positive at c, then f has a relative minimum at $x = c$.

If $f'(x)$ changes from positive to negative at c, then f has a relative maximum at $x = c$.

15. **Definition of Concavity**:

The graph of f is concave upward on (a, b) if $f'(x)$ is increasing on (a, b).

The graph of f is concave downward on (a, b) if $f'(x)$ is decreasing on (a, b).

16. **Test for Concavity with the Second Derivative**:

The graph of f is concave upward on (a, b) if $f''(x)>0$ for all x in (a, b).

The graph of f is concave downward on (a, b) if $f''(x)<0$ for all x in (a, b).

17. **Definition of Point of Inflection**:

There is a point of inflection of the graph of f at $x = c$ if the concavity of f changes

from upward to downward (or downward to upward) at the point.

18. **Test for Point of Inflection with the First Derivative**:

There is a point of inflection of the graph of f at $x = c$ if $f'(x)$ changes

from increasing to decreasing (or decreasing to increasing)at the point.

19. **The Second Derivative Test**: Let f be a function such that $f'(c)=0$.

If $f''(c)>0$, then f has a relative minimum at $x = c$.

If $f''(c)<0$, then f has a relative maximum at $x = c$.

20. **The First Derivative Test for Absolute Extrema**:

If $f'(x)<0$ for all $x < c$ and $f'(x)>0$ for all $x > c$, then f has an absolute minimum at $x = c$.

If $f'(x)>0$ for all $x < c$ and $f'(x)<0$ for all $x > c$, then f has an absolute maximum at $x = c$.

21. **Definition of Antiderivative**:

A function F is an antiderivative of f on an interval I if ____________ for all x in I.

22. **Left Riemann Sums**:

A left Riemann sum approximation of $\int_a^b f(x)\,dx$ is ____________ the actual value when f is ____________, and ____________ the actual value when f is ____________.

23. **Right Riemann Sums**:

A right Riemann sum approximation of $\int_a^b f(x)\,dx$ is ____________ the actual value when f is ____________, and ____________ the actual value when f is ____________.

24. **Trapezoidal Approximations**:

A trapezoidal approximation of $\int_a^b f(x)\,dx$ is ____________ the actual value when the graph of f is ________________, and ____________ the actual value when the graph of f is ________________.

25. **The First Fundamental Theorem of Calculus**: If a function f is ____________ on the interval ________ and F is an ____________ of f on the interval ________, then ______________________.

26. **Definition of the Average Value of a Function on an Interval**:

If f is integrable on the interval ________, then the average value of f on the interval is ______________.

27. **The Second Fundamental Theorem of Calculus**:

If f is ____________ on an interval I containing a, then, for every x in the interval, ____________________.

28. **The Net Change Theorem**: If ________ is a rate of change of a quantity ________, then the total (or net) change of ________ on the interval ________ is given by ____________________.

For Problems 29-30, $s(t)$ represents the position of a particle at time t, $v(t)$ represents the instantaneous velocity of the particle at time t, and $a(t)$ represents the instantaneous acceleration of the particle at time t.

29. **Particle Motion (Integration)**:

Average velocity on $[c, d]$: ______________ and average acceleration on $[c, d]$: ______________

30. **Particle Motion (Displacement vs. Total Distance)**:

Displacement on $[c, d]$: ____________ and total distance traveled on $[c, d]$; ____________