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

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

12. **The Mean Value Theorem**:

If f is $\underline{\text{continuous}}$ on the interval $\underline{[a, b]}$ and $\underline{\text{differentiable}}$ on the interval $\underline{(a, b)}$,

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

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

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

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

14. **The First Derivative Test**:

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

If $\underline{f'(x)}$ changes from $\underline{\text{positive}}$ to $\underline{\text{negative}}$ 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 $\underline{f'(x)}$ is $\underline{\text{increasing}}$ on (a, b).

The graph of f is concave downward on (a, b) if $\underline{f'(x)}$ is $\underline{\text{decreasing}}$ on (a, b).

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

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

The graph of f is concave downward on (a, b) if $\underline{f''(x)<0}$ 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 $\underline{\text{concavity}}$ of f changes

from $\underline{\text{upward}}$ to $\underline{\text{downward}}$ (or $\underline{\text{downward}}$ to $\underline{\text{upward}}$) 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 $\underline{f'(x)}$ changes

from $\underline{\text{increasing}}$ to $\underline{\text{decreasing}}$ (or $\underline{\text{decreasing}}$ to $\underline{\text{increasing}}$) at the point.

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

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

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

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

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

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

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

If ________ or if f is ______________ at c, then c is a critical number of f.

12. **The Mean Value Theorem**:

If f is ____________ on the interval ______ and ____________ on the interval ______,

then there exists a number c in ______ such that ________________.

13. **Test for Increasing and Decreasing Functions**: Let f be __________ on the interval ______.

If ________ for all x in (a, b), then f is increasing on ______.

If ________ for all x in (a, b), then f is decreasing on ______.

14. **The First Derivative Test**:

If ______ changes from ________ to ________ at c, then f has a relative minimum at $x = c$.

If ______ changes from ________ to ________ 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 ______ is ________ on (a, b).

The graph of f is concave downward on (a, b) if ______ is ________ on (a, b).

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

The graph of f is concave upward on (a, b) if ________ for all x in (a, b).

The graph of f is concave downward on (a, b) if ________ for all x in (a, b).

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

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

from __________ to __________ (or __________ to __________) at the point.

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

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

from __________ to __________ (or __________ to __________) at the point.

19. **The Second Derivative Test**: Let f be a function such that ________.

If ________, then f has a relative minimum at $x = c$.

If ________, then f has a relative maximum at $x = c$.

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

If ________ for all $x < c$ and ________ for all $x > c$, then f has an absolute minimum at $x = c$.

If ________ for all $x < c$ and ________ for all $x > c$, then f has an absolute maximum at $x = c$.