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| Topic 9: Calculus Option | *Limits of Sequences and Functions* |
| Algebraic limit laws: |  |  |
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| L’Hopital’s rule states if the following occurs: |  |  |  |
|  | or |  |
| Differentiate top and bottom fraction separately |  |  |  |  |
| The Squeeze Theorem states if: *Use when involving trigonometric functions* | Interval Notation: | A closed interval includes end points | An open interval excludes end points |
|  | and |  | A function is continuous at when: |
| Then: |  |
| The Absolute Value Theorem states:  | if , then  |
| A function is differentiable at a point if: |  must be continuous at  |
|  must not have a “sharp point” at  |
| the tangent to at must be vertical |
| The derivative of a function at the point can be found if the limit exists by:*If not, then the function is not differentiable at that point* |
|  | or |  |
| Rolle’s Theorem requires three conditions: *a and b are found from the given interval* |  is continuous on | Mean Value Theorem requires three conditions:*a and b are found from the given interval* |  is continuous on |
|  is differentiable on |  is differentiable on |
| = |  |
| If three conditions are met then there must be a point such that  | If these conditions are met, then there exists a point such that: |
| Topic 9: Calculus Option | *Improper Integrals* |
| The Fundamental Theorem of Calculus states if is continuous on where: | The p-series states for:  | Converges if  |
|  | *then* |  | Diverges if |
| And for any function where such that |  |  |
|  | *Where is the antiderivative of* |
| Integrals in the form are known as improper integralsImproper integrals are either convergent or divergent: | Convergent when  |
| *Divergent when*  |
| When integrating improper integrals, use and replace with  |  |
| The Comparison Test for improper Integrals states: | If for all then: |
|  is convergent if is convergent |
|  is divergent if is divergent |
| The Rienmann Sum states: | or a decreasing function for all, then there is an upper and lower sum such that: |  |
| For an increasing function for all , then there is an upper and lower sum such that: |  |

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| Topic 9: Calculus Option | *Series Part 1* |
| A series consists of  |  |  |
| It is denoted by: | For a total sum | For a partial sum |
| The Divergence Test states: | If or does not exist then diverges |
| If then may converge or may diverge |
| Key series types: | Geometric Infinite Series: | Converges if | Diverges if |
| Sum of infinite geometric series: |  |
| Telescoping Series:*Partial Fractions* | Find equation | Simplify  | Take  |
| P-Series: (*Harmonic Series:* ) | Converges if  |
| Diverges if |
| The Comparison Test states given for two series of positive terms: | If for all of and converges, then also converges |
| If for all of and diverges, then also diverges |
| Steps: | 1. Check if positive () |
| 2. Find ( generally is take away a useless term) |
| 3. Determine whether is smaller or larger than  |
| 3. Find if is convergent or divergent  |
| The Limit Comparison Test States: | If exists and and are positive to use limit comparison test: | Then both series either converges of diverges |
| Steps: | 1. Find ( generally is take away a useless term) |
| 2. Find if and are positive and if exists |
| The Integral Test states for , if | then  |  |  | Will both converge or diverge |
| Positive | Decreasing | Continuous | 1. Check criteria: If it’s positive decreasing and continuous | 2. Then integrate  |

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| Topic 9: Calculus Option | *Series Part 2* |
| The Alternating Series Test states for: | if and , then the series will converge |
| If: converges, then However, if does not approach then the Error of a Sum can be found: | The Absolute Converge states: For , if is convergent, then is absolutely convergent | *Use if series is not always positive, or not alternating, or when dealing with trig* |
| 1. Write as  |
| For alternative series only: | Note:Absolute convergence, is stronger than convergenceIf a series is absolute convergent, it must be convergentConditional convergence is when series converges, but is not absolutely convergent |
| The ratio test stages if:*Don’t need to use divergent test for ratio test* | 1. , is absolutely convergent |
| 2. , is divergent |
| 3. , is inconclusive |