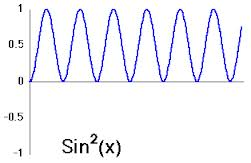
**Answer Sheet Mat 110 for Practice Sheet Exercise**

**(Please note these answers may not be 100% accurate)**

**Lecture 3: Domain & Range**

1. D: {x: x≠3}, R: {y: y≠0}
2. D: (-∞, -3] U [3,∞), R: [0, ∞)
3. D: [-3,3], R: [0,3]
4. D: (-∞, 2] U [3, ∞), R: [0, ∞)
5. D: {x: x≠0}, R: [-1,1]
6. D: (-∞,∞), R: (-∞,∞)
7. D:(- ∞, -1] U (-1, 1) U [1, ∞) = (-∞,∞), R: (-∞,1)U[-1,1]U(-∞,2] = (-∞,2]
8. D: (-∞,∞), R: (-∞,∞)U{2} = (-∞,∞)
9. D: (-∞,∞), R: [-3,3]
10. D: (-∞,2] U [5, ∞), R: (-∞,0]
11. D: {x:x≠4}, R: {y: y≠2}
12. D: {x: x≠-7/5}, R: {y: y≠0}
13. D: (-∞, ∞), R: [0, ∞)
14. D: (-∞,0)U[0,1]U(1,∞) = (-∞,∞), R: (0,∞)U[0,1]U(0,1) = [0,∞)
15. D: [-3,0]U(0,2)U[2,5] = [-3,5], R:[0,6]U{6}U[-2,4] = [-2,6]
16. D: (-∞, ∞), R: [0,1]



Graph of.

1. D: (-∞, ∞), R: (0,∞)
2. D: (0,∞), R: (-∞, ∞)
3. D: [-2, ∞), R: [0,∞)

**Lecture 4: Limit & Continuity**

**PROBLEMS:**

1. 2
2. 3/13
3. 1, x>0 and -1, x<0 limit is not continuous since two sided limits are not equal
4. 1, x<1, and 2, x>1 limit is not continuous since two sided limits are not equal
5. 2, x<1, and 2, x>1 limit is continuous since two sided limits are equal
6. For limit x = -2, (i) -∞, x<-2, (ii) -1, -2<x<3, (iii) x will never approach -2 since x>3 is given condition.

For limit x = 3, (i) x will never approach 3 since x< -2 is given condition, (ii) 4, -2<x<3, (iii) 4, x>3.

Limit is continuous at x = 3 since two sided limits are equal

1. ½
2. 0
3. 0
4. 1, x>0, and 1, x = 0, and 1, x<0 limit is continuous since two sided limits are equal
5. 5/2
6. 1, -1<x<0, and 0, 0<x<2 limit is not continuous since two sided limits are not equal
7. 1, x<1, and 2.4, x=1, and 2, x>1 limit is not continuous since two sided limits are not equal. Hence limit does not exists.
8. 3, x<1, and 2, x≥1, limit is not continuous since two sided limits are not equal
9. Prove was solved during lecture.

**Test the continuity of the following functions:**

1. Not continuous
2. Continuous
3. Not continuous
4. Continuous
5. Not continuous
6. Continuous
7. Continuous
8. Continuous at x = 0, continuous at x = π/2
9. Remove modulus; Test two sided limits then not continuous.
10. Not continuous
11. Continuous
12. Continuous

**Lecture 5: Continuity & Differentiability**

**Test the differentiability of the following function**

1. Differentiable at x= 0
2. Differentiable at x= 0
3. Not Differentiable at x= 0
4. Differentiable at x= 9, not continuous at x=9.
5. Continuous at x = 1 and not differentiable at x= 1
6. Not Differentiable at x= 0
7. Not continuous and differentiable at x= 1

**Lecture 6: Techniques of differentiation**

1(i) ½(2cos4x – 3cos6x +cos2x)

(ii) -3x cotx

(iii) -(5/2 sin5x + ½ sinx)

(iv)

(v) (x)

(vi)

(vii)

(viii)

(ix)

(x)

(xi) – cos[2 ] ×

(xii) cosecx

2(i) [lnx cotx + ln(sinx)]

(ii) (cosx cotx – sinx ln(sinx)) + (-sinx tanx + cosx ln(cosx))

3(i)

(ii)

(iii)

4(i) -tanθ

(ii)

(iii) 1

5(i) 1

(ii) ( x + lnx)

**Lecture 7: Maxima & Minima**

1(i) a) increasing on (2.5, ∞); b) decreasing on (-∞, 2.5); c) concave up on (-∞,∞) d) none

e) no inflection.

(ii) a) increasing on (-2,2); b) decreasing on (-∞, -2)U(2, ∞); c) concave up on (-∞,0)

d) concave down on (0,∞); e) inflection point at x = 0

(iii) a) increasing on (-2,0)U(2,∞); b) decreasing on (-∞, -2)U(0,2); c) concave up on (-∞,-)U(,∞)

d) concave down on (-); e) inflection point at x = -,

(iv) a) increasing on (0,∞); b) decreasing on (-∞, 0); c) concave up on (,

d) concave down on (-∞,) U(; e) inflection point at x = , .

(v) a) increasing on (-∞,-2); b) not decreasing; c) concave up on (-∞,-2)

d) concave down on (-2,∞); e) inflection point x≈2.

2. (i) C.N. & S.P. = -3,1; (ii) C.N. & S.P. = 0,- , ;

(iii) C.N. = ± , ± & S.P.= ± ; (iv) C.N. x = 0; There is no stationary point (v) C.N. x = , 0; S.P. x =

(vi) C.N & S. P. x = 0.

3(i) c# 1, 2; by 1st and 2nd derivative test f has relative maximum at x=1, relative minimum at x = 2

(ii) c#, ; by 1st and 2nd derivative test f has relative minimum at x = π/3, relative maximum at x = .

4(i) c# 0, ± ; by 2nd derivative test f has relative minimum at x = ±. Test inconclusive at x = 0. 1st derivative test maxima at x=0.

(ii) C.N. x = ±1, ; by 2nd derivative test f has relative maximum at x = -1 and relative minimum at x = 1. Unable to check relative extrema for imaginary critical number.

**Lecture 8: Rolle’s and Mean Value Theorem**

**Rolle’s Thm**

1. C = 3
2. C = π
3. C = 1

**MV Thm**

1. = -1, = 1
2. C = 5/4
3. C =

**Lecture 9: Successive Differentiation, Taylor’s & Maclaurine’s Theorem**

**Successive Differentiation**

1. n!
2. n!
3. (n-1)! (
4. n!
5. sin(ax + b +)
6. cos(ax + b +)
7. sin(x +)- sin (3x +)

**Taylor’s Thm**

1. The series is not defined.

2. ln2 + ½ (x-2) - + ….. +

3. + a (x-1) + + …. +

**Maclaunine’s Thm**

1. Infinite series: x + + + …………infinite series.
2. x - + - …….+
3. 1 + x + ½ + + ……. +

**Lecture 10: Leibniz’s Theorem, Indeterminate form: L’Hospital’s rule**

**Leibniz’s Theorem**

All exercises are proof

**Indeterminate form: L’Hospital’s rule**

1. 1
2. 2/5
3. -1
4. 0
5. 0
6. 0
7. 1
8. 1/3
9. 2
10. 0

**Lecture 11: Partial Derivatives**

1. (a) 9
2. 6y
3. 9
4. 6y
5. 36
6. 12
7. (a) 8/3

(b) 8

1. (a) 3/8

(b) ¼

1. (a) 8 + 84

(b) 140

(c) 140

(d) 140

1. (a) 15.88

(b) -7.956

1. (a) -1/4

(b) -1/4

1. (a)15 + 2y

(b) 35 + 3

(c) 21

(d) 42

(e) 140 + 6y

(f) 105

(g) 105

(h) 210*x*

1. = (y) + - tan z

= + - tan z

= 0 + - x z

= - xz

=

=

= = =

= 0

**Tangent & Normal: (OMIT)**

1. (a) T: y = 9x – 16; N: x + 9y 16 = 0. (b) f(x) = , T: y = 3x -7; N: x + 3y = -11
2. T: y = - , N: y = (x+)
3. T: x + y =0, N: y – x = 0
4. (i) = , = 3, = , = (ii) = , = 2, = , =
5. Proof
6. = ()

**Transformation:**

1. (4, ), (2, ), ()
2. (), (5.66, 5.66), (0,0)
3. ;
4. = 36;

**Pair of Straight Lines:**

1. (i) (x,y) = (1, 0), ; (ii) (x,y) = (1, 5/2), ; (iii) (x,y) = (1/2, -3/8), , (iv) (x,y) = (-2,1),
2. (i) 1, -½, (ii) -4, (iii) 9/2, 3 (iv) 2
3. **Eqn of Bisectors** (i) ;

(ii)

(iii)

(iv)

**Circle:**

1. (i)

(ii)

(iii)

1. (i) Centre (11/10, 9/10), Radius:

(ii) Centre (-1, -1), Radius: 1

(iii) Centre: (-1,2), Radius:

1. (i)

(ii)

(iii)

1. Proof
2. -13/21, -3

The equation of any line parallel to 3x-4y+1=0 is 3x-4y+λ=0 ----------(i)

Given circle:

Center of the circle: (2,,

Transform 3x-4y+λ=0 to parallel axes through (2,3)

3(x+2)-4(y-3)+ λ=0

3x+6-4y+12+ λ=0

-4y=-18- λ-3x

4y = 3x + λ +18

y=

m= , =

By the condition of tangency:

= 16+(1+)

=2

Substitute =2 into equation (i)

3x-4y+2=0, required equation of tangent.

1. Proof

**Conic:**

1. (i) Hyperbola:

(ii) Ellipse:

(iii) Parabola: =

(iv) Parabola:

(v) Pair of Straight Lines

(vi) No Real Locus

1. Centre: (2,3)