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## at MET Bhujbal Knowledege City

Engg Maths 1 Department

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| Ballicea Signatura ing disempahyan Nastwelingkan Dawasan nagan ing  | Hyperbolic Functions, Logarithms   |
| Schedule Schedule (1994) et de la company de la company<br>Schedule (1995) et de la company de la compa | Of Complexe Numbers  |
| ecymentede-fined hydrical bed held by the death sold algorithms over the measurement.   | o ° la la companya da la co |
| #   | Circular functions of a complex Variable   |
|   | Euler's formulae: $e^{i\Re} = \cos\Theta + i\sin\Theta$<br>$e^{-i\Re} = \cos\Theta - i\sin\Theta$  |
|   | 하다 이 집에서는 마이탈 (전) 상태를 받았다. 아이들은 마이트 이 사람들은 아이들은 사람들은 사람들은 사람들은 사람들은 사람들은 사람들은 사람들은 사람  |
|   | $(05) = e^{ix} + e^{-ix}$ ; $\sin x = e^{ix} - e^{-ix}$  |
|   |  |
|   | Circular function for real x.  |
| and the process   | 유하다 하하는 사람이 있는데, 그를 하다면 보고 있는데 보고 있다.   |
|   | <u>Circular</u> functions of complex Variable  Z = x+iy  |
|   | P 0  |
|   | $\cos Z = e^{iZ} + e^{-iZ}$ $\sin Z = e^{iZ} - e^{-iZ}$ $2$ $2$  |
|   | $tan Z = \frac{\sin Z}{\cos Z} = \frac{e^{iZ} - e^{-iZ}}{i(e^{iZ} + e^{-iZ})}$   |
| (2) (1) (1) (1) (1) (1) (1) (1) (1) (1) (1  |  |
|   | $\cot z = \frac{\cos z}{\sin z} = \frac{i(e^{iz} + e^{-iz})}{e^{iz} e^{iz}}$   |
|   |  |
|   | $Sec = 1$ $Cos = 2$ $e^{iz} + e^{-iz}$   |
|   |  |
|   | $\frac{\text{Cosec} z = 1 - 2i}{\text{Sin} z} = \frac{1}{e^{iz}} = \frac{2i}{e^{iz}}$  |
|   | Hyperbolic functions   |
|   | $\sinh x = e^{x} - e^{-x},  \cosh x = e^{x} + e^{-x}$  |
|   | 2  |
|   | $\frac{\tanh x = \sinh x}{\cos hx} = \frac{e^{x} - e^{-x}}{e^{x} + e^{-x}}$  |
|   |  |

|               | cothx =                                 |  | ex+e-x   | A STATE OF THE STA |  |  |
|---------------|---|--|--|--|--|--|
|               |   | tanha                                      | ex-e-x   |  |  |  |
|               |   |  | The state of the s | 1-36-200   |  |  |
|               | sechx =                                 | _  | 2  |  | - 4- 1   |  |
|               |   | Coshx                                      | $e^{\alpha}+e^{-\alpha}$   |  |  |  |
| ez lig        |   |  |  |  |  |  |
|               | cosecha                                 | = )  | _ 2  |  |  |  |
|               |   | = 1<br>Sinhx                               | - ez-e-  | L  |  |  |
|               |   | The property of                            | rnary = (  |  |  |  |
|               | Sin h (-x)                              | $) = - \sinh$                              | x & C  | osh(-x) = c  | oshx   |  |
|               | $\sim$                                  |  |  | The Carlot   |  |  |
|               | odd fu                                  | in" of &                                   |  | even funn  | of æ.  |  |
| #             | home to                                 | 00-10-01                                   |  | ) = xxneesf  |  |  |
| 77            | Some Im                                 | portant                                    | +ormwa e   |  |  |  |
|               | £ = 1+x                                 | $+\frac{\chi^{2}}{21}+\frac{\chi^{3}}{31}$ | P 1  |  |  |  |
|               |   | 0 0  |  |  |  |  |
|               | 0 <sup>-x</sup> - 1 - c                 | л <del>Т</del> Д <sub>2</sub>              | 3  | = xodais   |  |  |
|               |   | $\frac{\lambda}{2l} = \frac{\lambda}{3}$   | <del></del>  | Trans.   | -  |  |
|               |   |  |  |  |  |  |
| ndertalesen ( | sinhx = x                               | + 23 + 25                                  | + 27 +   | TENE-KAN   |  |  |
|               |   | 3 5  | 7]   |  |  |  |
|               |   | 4  |  | 744.2 + 1 A 4 2 5  | Carlotta and the carlot |  |
|               |   |  |  |  |  |  |
|               |   | 2, 4,                                      |  |  |  |  |
|               |   |  |  |  |  |  |
|               | 2                                       | sinhx                                      | coshx  | tanha  | *  |  |
|               | -00                                     | -00  | ∞  |  | 4 - 32   |  |
|               | O                                       | ∞  |  | 0  |  |  |
|               |   | <u> </u>                                   | ∞  | La de la companya de   |  |  |
| :#            | Delation b                              | setmeen (                                  | ircoolor   | and Hyper  |  |  |
| T             | functions                               |  |  | any myper  | POLIC  |  |
|               | ,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,, |  |  |  | Section .  |  |
|               | sin (ix)                                | = i sinha                                  | Co.  | t (ix) = -ic   | ot ba  |  |
|               |   |  |  | Contract of the Contract of th |  |  |
|               | (os(ix)                                 | = cosha                                    | · 5e   | c(ix) = sec  | ba   |  |
|               |   |  | Non-Article  |  |  |  |
|               | tan Cix                                 | () = i tanh                                | ) or (.c   | sec(ix) = -  | icosecha   |  |
|               |   |  |  |  |  |  |

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| #           | Formulae of Hyperbolic functions:  |                      |
|             | $(\cosh^2 x - \sinh^2 x = 1)$  |                      |
| (2)         | $\operatorname{sech}^{2}x + \operatorname{tanh}^{2}x = 1$                                      |                      |
| (3)         | $\cot h^2 x - \operatorname{cosech}^2 x = 1$   | A CONTRACTOR SECTION |
| 4           | sinh(x±y) = sinhx coshy + coshx.sinhy  | 9                    |
| (5)         | cosh(x±y) = coshx. coshy + sinhx. sinhy  |                      |
| (6)         | $\cosh 2x = \cosh^2 x + \sinh^2 x$   |                      |
|             | $= 2 \cosh^2 \chi - 1$ $= 1 + 2 \sinh^2 \chi$  |                      |
| 9           | $sinh2\alpha = 2 sinhx cosh2$  |                      |
| 8           | $\sinh x + \sinh y = 2 \sinh \left(\frac{x+y}{2}\right) \cdot \cosh\left(\frac{x-y}{2}\right)$ |                      |
| · (9)       |  | Fig. 2. de           |
| (jo         |  |                      |
| <u>(ii)</u> |  |                      |
| <u> </u>    | tanh(x±y) = tanhx ± tanhy  1 ± tanhx tanhy   |                      |
| 13          | $\sinh x = 2 + 9 n h \frac{x}{2}$  |                      |
|             | 1 - tanh2 2  | 1                    |
| 14          | $\frac{1 + \tanh^2 \frac{\pi}{2}}{1 - \tanh^2 \frac{\pi}{2}}$                                  | 1                    |
| (15         | 2  | /<br>/               |
|             | $1 + \frac{\tanh^2 x}{2}$  |                      |
| (16)        | $\sinh 3\alpha = 3 \sinh hx + 4 \sinh^3 \alpha$  |                      |
| (17)        | Cosh 3x = 4 cosh3x - 3 coshx   |                      |

|          | 18   | $\frac{d}{dx}\left(\sinh n\right) = \frac{d}{dx}\left(\frac{e^{x}-e^{-x}}{2}\right) = \frac{e^{x}+e^{-x}}{2} = \cosh x$ |
|----------|------|---|
|          |      |   |
|          | (19) | $\frac{d\left(e^{x}+e^{-x}\right)-d\left(\cosh x\right)=e^{x}-e^{-x}=\sinh x}{dx}$                                      |
|          |      |   |
|          | (20) | $d(tan hx) = sech^2x$   |
|          |      |   |
|          | 21)  | $\int \cos h x  dx = \sinh hx$  |
|          | (22) | $\int \sinh x  dx = \cosh x$  |
|          |      |   |
|          | 23   | $\int \operatorname{sech}^2 x  dx = \operatorname{tanh} x$  |
|          | #    | Inverse trigo Hyperbolic function:  |
|          |      | $\sinh^2 \alpha = \log \left( x + \sqrt{x^2 + 1} \right)$   |
|          | (24) |   |
| <u> </u> | 25   | $\cosh^{-1}x = \log(x + \sqrt{x^2 - 1})$  |
|          | (26) | $\frac{1}{2} \frac{1}{2} \frac{\log \frac{1+\chi}{1-\chi}}{1-\chi}$   |
|          |      | 2 J I - K   |
| _        | (27) | $\sinh^{-1} x = \cosh^{-1} \sqrt{1 + \alpha^2}$   |
|          |      | $9inh^{-1}x = +anh^{-1}x$   |
|          | 28   | J1+x2   |
|          |      |   |
|          |      |   |



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