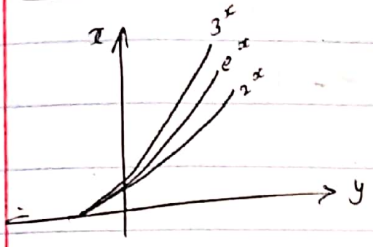
Multiple choice

Q1



Q2: $\ln(0)$ = undefined

Q3: $f(x) = 10^x$

$f'(x) = 10^x \ln(10)$

Q4. $f(0) = 0e^0$

$= 0$

Q5. $f(x) = \frac{x}{e^x}$

$f'(x) = \frac{1-x}{e^x}$; Quotient rule.

$f'(0) = \frac{1}{e^0} = 1$

Q6 $f(x) = x2^x$

$f'(x) = x \frac{d}{dx}(2^x) + 2^x \frac{d}{dx}(x)$

$= x2^x \ln(2) + 2^x$

$f'(0) = 0 + 2^0 = 1$

Q7. $f(x) = 2x^2 e^x$

$f'(x) = 2x^2 \frac{d}{dx} e^x + e^x \frac{d}{dx} 2x^2$

$= e^x 2x^2 + e^x 4x$

$f'(1) = e^1 \cdot 2 + e^1(4)$

$= 6e$

Q8

$f(x) = x^2 e^x$

$f'(x) = x^2 \frac{d}{dx} e^x + e^x \frac{d}{dx} x^2$

$= e^x x^2 + 2x e^x$

$f'(1) = e^1 + 2e^1$

$= 3e$

Q9. $f(x) = e^x (e^x)^{1/2}$

$f'(x) = e^x \frac{d}{dx}(e^x)^{1/2} + \sqrt{e^x} \frac{d}{dx} e^x$

$= e^x \cdot \frac{e^x}{2\sqrt{e^x}} + \sqrt{e^x} \cdot e^x$

$f'(2) = e^2 \cdot \frac{e^2}{2\sqrt{e^2}} + e * e^2$

$= e^2 \cdot \frac{e^2}{2e} + e^3$

$= \frac{3e^3}{2}$

Q10 $f(x) = e^{\sin x}$

$f'(x) = \cos(x) e^{\sin x}$

$f''(x) = -\sin(x) e^{\sin x} + \cos^2(x) (e^{\sin x})$

$f''(0) = 0 + 1(e^0) = 1$

Q11: $f(x) = \frac{1}{e^x}$

$f'(x) = -e^{-x}$

$f''(x) = e^{-x}$

$e^{-(-1)} = e^1 = e$

Q12 $f(x) = x^2 e^x$

$f'(x) = 2xe^x + e^x \cdot x^2$

$f'(1) = 2e + e$

$= 3e$

$y - e = 3e(x-1)$

$y = 3ex - 2e$

Q13

$y = x$; $m = 1$

$f(x) = e^x + x$

$f'(x) = e^x + 1$

~~$e^x + 1 = 1$~~ $m = 1$;

~~$e^x = 0$~~ $e^x + 1$

$x =$ $e^0 + 1 = 1$

$= (0, 1)$

Q14

$y = 2ex$

$m = 2e$

$y' = 2e^{2x+1}$

$\not{2}e^{2x+1} = \not{2}e$

$1 = 2x + 1$

$2x = 0$

$x = 0$

$= (0, e)$

Q15

$y' = e^x$

$e^0 = 1$; $m = 1$

$y - 1 = 1(x - 0)$

$y = x + 1$

Q16

$y = 3(2^x)$

$y' = 3(2^x \ln(2))$

$m = 3(2^0 \ln(2))$

$= 3\ln(2)$

$y - 3 = 3\ln(2)(x - 0)$

$y - 3 = 3\ln(2)x$

$y = 3\ln(2)x + 3$

Q17

$y = 6e^x + 5$; $m = 6e$

$y' = 3e^x + 3e$

$3e^x + 3e = 6e$; $x = 1$

$y(1) = 6e$

$y - 6e = 6e(x - 1)$

$y = 6ex$

Q18

$M(t) = M_0 \left(\frac{1}{2}\right)^{t/3.8}$

$M_0 = 80$

$t = 30$

$M(t) = 80 \left(\frac{1}{2}\right)^{30/3.8}$

$= 80 \cdot 0.579$

$= 46.9$

Q19

$M_0 = 200$

12.5% of its initial mass.

$1 - 0.125 = 0.875$

$0.875 = 0.5^{x/3.8}$

$\ln(0.875) = \frac{x}{3.8} \ln 0.5$

$x = \left(\frac{\ln 0.875}{\ln 0.5}\right) 3.8$

$=$

$0.125 = 0.5^{x/3.8}$

$x = \frac{\ln(0.125)}{\ln(0.5)} 3.8$

$11.4 \approx 11$ days

Q20

$x(t) = 1.5 \cos(t) e^{-0.05t}$

$x'(t) = 1.5 \left[\cos(t) \cdot \frac{d}{dt} e^{-0.05t} + e^{-0.05t} \frac{d}{dt} \cos(t)\right]$

$= 1.5 \left(-\cos(t) e^{-0.05t} \cdot 0.05 + e^{-0.05t} - \sin(t)\right)$

$V(t) = 1.5 \left(-e^{-0.05t} \sin t - 0.05 e^{-0.05t} \cos t\right)$

$a(t) =$

$\frac{d}{dx} -e^{-0.05t} \sin(t) = -e^{0.005t} \cos t + (-\sin t \cdot 0.05 e^{-0.05t})$

$\frac{d}{dx} e^{-0.05t} \cos t = -e^{-0.05t} \sin t + -\cos t \cdot 0.05 e^{-0.05t}$

$\Rightarrow a(t) = 1.5 \left(0.1 e^{-0.05t} \sin t - 0.998 e^{-0.05t} \cos t\right)$

~~d~~ $a(t) = 0$ $\quad 3e^{-1/20}(2\sin x + x \cos x) = 0$

$2 \sin x + x \cos x = 0$

$x = 0$ $\quad x = 1.47087$

$v(0) =$ ~~1.5t~~

$v = -1.5$