Week 14 Questions and Answer Key

- Day 1, 21-22
- Day 2, 23-28
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- Day 4, Review
- Day 5, Test

21. It can be shown that, when an armature of radius r rotates at ω radians per second, a point on its circumference is given a constant normal acceleration toward the center equal to $a_n = r\omega^2$. If an armature 0.3 meters in diameter is rotated at 2,000 revolutions per minute, (a.) to what normal acceleration will a conductor on the surface be subjected? Using $f = ma$, (b.) what centrifugal force in newtons will be applied to a conductor of mass 0.04Kg located at the circumference?

    $a_n = 6.5797 Km/s^2$

    $F = 263.189\ newtons$

22. When power is applied to a motor, the shaft speed during initial power-up corresponds to $10t + 4t^2$ revolutions per second. (a.) Write an equation for the angular speed ω, in radians per second of the shaft. (b.) Find an equation for the angular acceleration α of the shaft at any time. (c.) Find an equation for the angle θ, in radians, of the shaft position at any time. (d.) Find the angular position θ, in degrees, at t1 = 0.1 sec & t2 = 0.2 sec. (assume $\theta = 0$ when t = 0).

    $\omega = (10t + 4t^2)2\pi\ radians/sec$

    $\alpha = 2\pi(10 + 8t)\ radians/sec^2$

    $\theta = 10\pi t^2 + \frac{8\pi t^3}{3} + C\ radians$

    $\theta_{t1} = 18.48°$

    $\theta_{t2} = 75.84°$

Perform the derivative for the following functions.

23. $y = \sin 2x$

    $\frac{dy}{dx} = 2(\cos 2x)$

24. $y = 3\sin x$

    $\frac{dy}{dx} = 3(\cos x)$

25. $y = 12\sin 14t$

    $\frac{dy}{dt} = 168(\cos 14t)$

26. $y = 10\sin 10t^{\frac{1}{2}}$

    $\frac{dy}{dt} = 50t^{\frac{-1}{2}}(\cos 10t^{\frac{1}{2}})$

27. $y = \sin t^2$

    $\frac{dy}{dt} = 2t(\cos t^2)$

28. $y = \cos 3t^3$

    $\frac{dy}{dt} = -18t^2(\sin 3t^3)$

29. $y = 500\cos(t^2 - t)^{\frac{1}{2}}$

    $\frac{dy}{dt} = \frac{-250(2t-1)}{(t^2-t)^{\frac{1}{2}}}\sin(t^2 - t)^{\frac{1}{2}}$

30. $y = 10t^3 + \cos t$

    $\frac{dy}{dt} = 30t^2 - \sin t$

31. $y = \sin^2 t$

    $\frac{dy}{dt} = 2\sin t\cos t$

32. $y = -\cos^2 t^{-1}$

    $\frac{dy}{dt} = \frac{-2}{t^2}(\cos t^{-1})(-\sin t^{-1})$

33. $y = 2\sin^2 t^2$

    $\frac{dy}{dt} = 8t(\sin t^2)(\cos t^2)$

34. Let the primary current in a transformer be $i_1 = I_{Max}\sin\omega t$, Where I_{Max} is the crest value of the current. Write a formula for the induced secondary emf v_2.

    $v_2 = -m(I_{Max} \times \omega)(\cos\omega t)$

35. A voltage $v = 2,000\sin 500t$ is impressed across a 20μF capacitor. Find a formula for the resulting current.

    $Ic = 20\cos 500t$