Name SOLUTIONS

EE 331 – Basic Math Assessment

1. Give an example of an equation for a parabola in terms of x and y.

$$y = x^2$$

2. What is the volume of a cylinder of radius r m and length L m?

$$V = \pi r^2 L \ \ [\mathrm{m}^3]$$

3. What is the surface area of a sphere of radius r m?

$$S = 4\pi r^2 \ \ [\mathrm{m}^2]$$

4. What is the circumference of a circle of radius r m?

$$C = 2\pi r \ \ [\mathrm{m}]$$

5. Write down the Pythagorean theorem.

$$a^2 + b^2 = c^2$$

6. Write down Euler's rule (also called Euler's identity or Euler's law).

$$e^{\pm jx} = \cos x \pm j \sin x$$

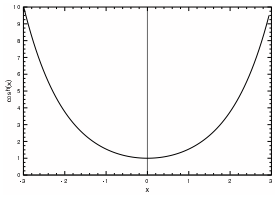
7. Write down the solution to the quadratic equation.

$$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$

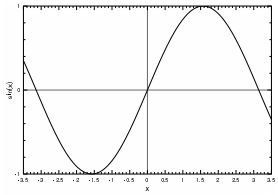
8. Write down the sum of the first two non-zero terms of the Taylor series for $\sin x$ expanded about 0.

$$\sin x \approx x - \frac{x^3}{6}$$

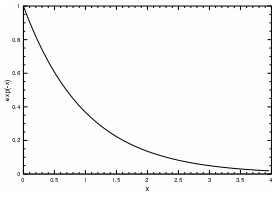
9. Sketch $y = \cosh x$.



10. Sketch $y = \sin x$.



11. Sketch $y = e^{-x}$ for $x \geq 0$.



Evaluate, simplify, convert to or from phasor form, or identify the following (eliminate any complex denominators):

12. $(\widehat{\mathbf{a}}_x \times \widehat{\mathbf{a}}_y) \cdot \widehat{\mathbf{a}}_z = 1$

13. $10^2 \times 10^5 = 10^7$

14. $e^x e^x = e^{2x}$

15. $\sqrt{-1} = j$

16. $\sin^2\theta + \cos^2\theta = 1$

17. $\dfrac{2+j3}{2-j3} = \dfrac{(2+j3)(2+j3)}{(2-j3)(2+j3)} = \dfrac{4+j6+j6+j^2 9}{2^2+3^2} = \dfrac{4+j12-9}{13} = \dfrac{-5+j12}{13}$

18. $\ln(1) = 0$

19. $\dfrac{e^x - e^{-x}}{2} = \sinh x$

20. $\dfrac{d\sin x}{dx} = \cos x$

21. $\dfrac{d\, xe^{2x^2}}{dx} = e^{2x^2} + x\dfrac{d\, e^{2x^2}}{dx} = e^{2x^2} + xe^{2x^2}4x = (4x^2+1)e^{2x^2}$ (product and chain rules)

22. $\int \sin x \cos x dx = \int u\, du = \dfrac{u^2}{2} + C = \dfrac{(\sin x)^2}{2} + C'$

23. $\int \frac{dx}{x} = \ln|x| + C$

24. $\int_{-a}^{a} x^2 \sin x dx = 0$ (odd function over interval $[-a, a]$)

25. $V_s(z) = 2e^{-(1+j2)z+j\pi/3} \rightarrow V(z,t) = 2e^{-z}\cos(\omega t - 2z + \pi/3)$

26. $V(z,t) = V_0 \cos(3t - 2z + \pi/3) \rightarrow V_s(z) = V_0 e^{-j(2z-\pi/3)}$

Answer the following true (T) or false (F) where **A** and **B** are vectors:

27. $\sin(-\theta) = -\sin(\theta)$ T

28. $\log(\frac{x}{y}) = \log(x) + \log(y)$ F

29. $\mathbf{A} \cdot \mathbf{B} = \mathbf{B} \cdot \mathbf{A}$ T

30. $\mathbf{A} \times \mathbf{B} = \mathbf{B} \times \mathbf{A}$ F

In the final problems, $f(x,y) = x^2 + 2xy - y^2$, $\mathbf{A} = 2\hat{\mathbf{a}}_x - 3\hat{\mathbf{a}}_y + \hat{\mathbf{a}}_z$, and $\mathbf{B} = \hat{\mathbf{a}}_x + 2\hat{\mathbf{a}}_z$.

31. $\frac{\partial f(x,y)}{\partial x} = 2x + 2y$

32. $\frac{\partial f(x,y)}{\partial y} = 2x - 2y$

33. $\frac{\partial^2 f(x,y)}{\partial x \partial y} = 2$

34. $\nabla \times \nabla f(x,y) = 0$ (curl of grad is always zero)

35. $\mathbf{A} \cdot \mathbf{B} = (2)(1) + (-3)(0) + (1)(2) = 4$

36. $|\mathbf{A} \cdot \mathbf{B}| = 4$