

# Math assignment answers

1. Angle between curves:  $\phi = \frac{\pi}{4}$
2. Pedal equation:  $p^2 = r^2 - a^2$
3. To prove
4.  $xU_x + yU_y + zU_z = -7 \tan U$
5.  $\frac{df}{dt} = 3 \sin 4t \sin 2t (\log t)^2 + 2 \cos 2t \log t \cos(\sin 2t) + \frac{2}{t} \log t \sin^3 2t + \frac{1}{t} \sin(\sin 2t)$
6.  $\frac{\partial(U,V)}{\partial(x,y)} = 0$  and relation:  $1 - U^2 = 4V$
7. Length of curve:  $s = \frac{5}{2}(e^\pi - 1)$
8. Value of integral:  $4\pi$
9. Length of curve:  $s = \sqrt{1+e^2} - \sqrt{2} + \frac{1}{2} \ln \left| \frac{(\sqrt{1+e^2}-1)(\sqrt{2}+1)}{(\sqrt{1+e^2}+1)(\sqrt{2}-1)} \right|$
10. Area common to circles:  $A = a^2(\pi - 1)$
11. Volume about x-axis:  $V = \frac{1296}{5}\pi$  and Volume about y-axis:  $V = 216\pi$
12. To prove
13.  $\nabla \times \vec{F} = 0$  and scalar potential:  $\phi = \frac{x^2 y^2 z^2}{2}$
14. To prove
15. Component of velocity:  $\sqrt{11} \text{ m/s}$  and Component of acceleration:  $\frac{8}{\sqrt{11}} \text{ m/s}^2$
16. Maximum rate of change:  $|\nabla\phi| = 324\sqrt{2}$  and direction:  $\nabla\phi = 108\hat{i} + 108\hat{j} - 432\hat{k}$
17. To prove
18. Angle between curves:  $\theta = \cos^{-1} \left( \frac{8}{3\sqrt{21}} \right)$
19. Value of double integral:  $\ln|4|$
20. Value of double integral:  $\frac{463}{48}$
21. A)  $\frac{2\pi a^3}{3} \left( 1 - \frac{1}{\sqrt{2}} \right)$  and B)  $\frac{2\pi hb}{3} (2h^2 + b^2)$

22. Value of double integral:  $1 - \frac{1}{\sqrt{2}}$

23. I don't know (lengthy)

24. Not in syllabus

25. Value of double integral:  $\frac{4a^2}{3}(10 - 3\pi)$

26. Not in syllabus