

MATH 250 Homework 19 Solutions

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Sec 14.6 #16.

$$z = \frac{1}{2}(x^2 + y^2) \Rightarrow 2z = x^2 + y^2 \Rightarrow z \geq 0$$

$$x^2 + y^2 + z^2 = 2z + z^2 = 80 \Rightarrow 2z^2 + 2z - 80 = 0$$

$$\Rightarrow z = 8 \Rightarrow x^2 + y^2 = 2z = 16$$

So, the given integral is

$$\int_{-4}^4 \int_{-\sqrt{16-x^2}}^{\sqrt{16-x^2}} \int_{\frac{1}{2}(x^2+y^2)}^{\sqrt{80-x^2-y^2}} dz dy dx$$

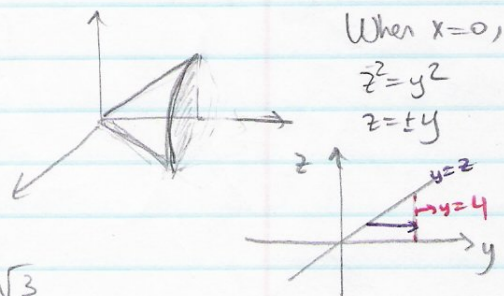
#22.

$$\begin{aligned} \int_0^2 \int_0^{2-x} \int_0^{9-x^2} dz dy dx &= \int_0^2 \int_0^{2-x} (9-x^2) dy dx = \int_0^2 (9-x^2)(2-x) dx \\ &= \int_0^2 (18-9x-2x^2+x^3) dx = 18x - \frac{9}{2}x^2 - \frac{2}{3}x^3 + \frac{1}{4}x^4 \Big|_0^2 = \frac{50}{3} \end{aligned}$$

#26.

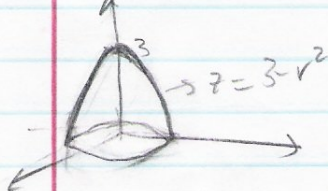
Elliptic cone: $4x^2 + z^2 = y^2$

$$\int_0^4 \int_{-z}^z \int_0^{\sqrt{\frac{y^2-z^2}{2}}} dx dy dz$$



14.7 #10

$$\begin{aligned} \int_0^{2\pi} \int_0^{\sqrt{3}} \int_0^{3-r^2} r dz dr d\theta &= \int_0^{2\pi} \int_0^{\sqrt{3}} r(3-r^2) dr d\theta \\ &= \int_0^{2\pi} d\theta \cdot \int_0^{\sqrt{3}} (3r - r^3) dr = \frac{9\pi}{2} \end{aligned}$$



#12.

$$\begin{aligned} \int_0^{2\pi} \int_0^{\pi} \int_2^5 \rho^2 \sin \phi d\rho d\phi d\theta &= \int_0^{2\pi} d\theta \cdot \int_0^{\pi} \sin \phi d\phi \cdot \int_2^5 \rho^2 d\rho \\ &= 2\pi \cdot [-\cos \phi]_0^{\pi} \cdot \left[\frac{\rho^3}{3} \right]_2^5 \\ &= 156\pi \end{aligned}$$

