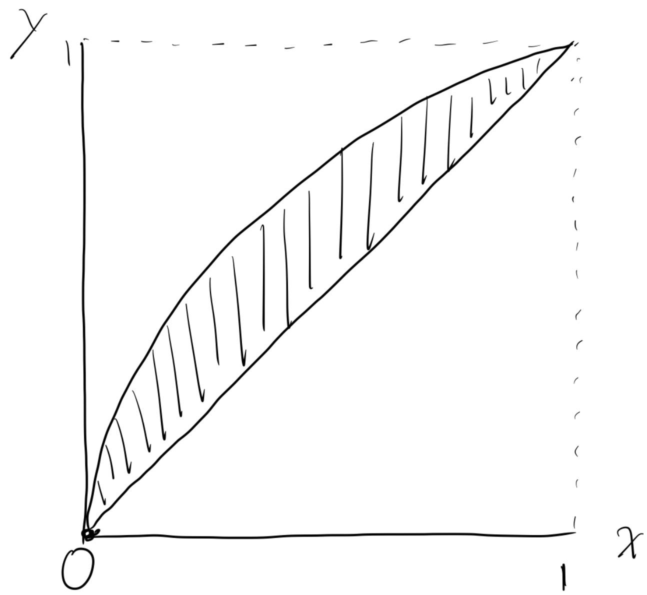
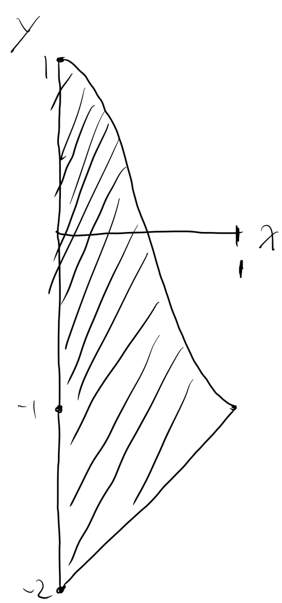
16.2

2:



4:



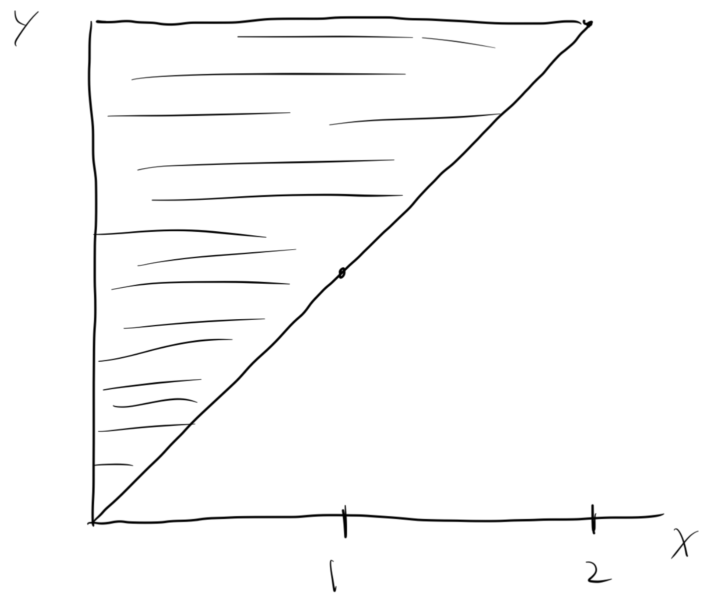
6:

$$
\begin{aligned}
\int_0^2 \int_0^3 (x^2+y^2)\ dy\ dx &= \int_0^2 \left(x^2 y + \frac{y^3}{3}\Big|_{y=0}^{y=3} \right)\ dx \\
&= \int_0^2 \left(3x^2+9\right)\ dx \\
&= x^3 + 9x\Big|_0^2 \\
&= 26
\end{aligned}
$$

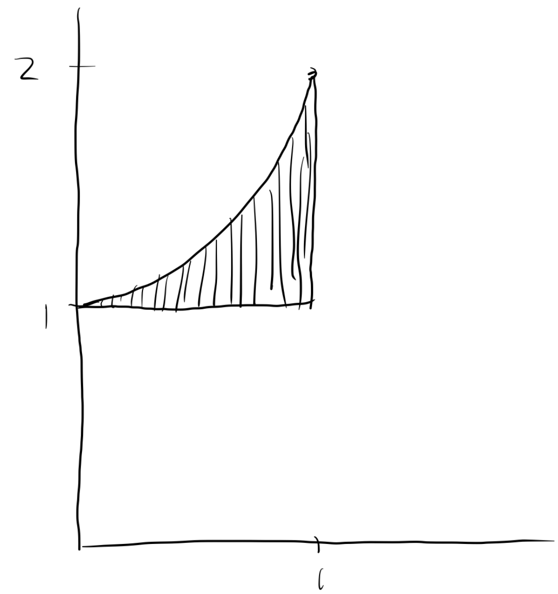
12:

$$\begin{aligned}\int_0^{\pi/2}\int_0^{\sin x} x\ dy\ dx &= \int_0^{\pi/2}\left(xy\Big|_{y=0}^{y=\sin x}\right)\ dx\\ &= \int_0^{\pi/2} x\sin x\ dx\\ &= \sin x - x\cos x\Big|_0^{\pi/2}\\ &= 1\end{aligned}$$

14:



$$\begin{aligned}\int_0^2\int_0^x e^{x^2}\ dy\ dx &= \int_0^2\left(ye^{x^2}\Big|_{y=0}^{y=x}\right)\ dx\\ &= \int_0^2 xe^{x^2}\ dx\\ &= \frac{1}{2}\int_0^4 e^u\ du && u = x^2,\ du = 2x\ dx\\ &= \frac{1}{2}\left(e^4-1\right)\end{aligned}$$



20:

$$\int_0^1 \int_1^{1+x^2} \frac{x}{\sqrt{y}}\ dy\ dx = \int_0^1 \left(2x\sqrt{y}\Big|_1^{1+x^2} \right)\ dx$$
$$= \int_0^1 2x\sqrt{1+x^2}\ dx - \int_0^1 2x\ dx$$
$$= -\frac{1}{2} + \int_1^2 \sqrt{u}\ du \qquad u = 1+x^2,\ du = 2x\ dx$$
$$= -\frac{1}{2} + \frac{2}{3}\left(u^{3/2}\Big|_1^2 \right)$$
$$= -\frac{1}{2} + \frac{2}{3}\left(2\sqrt{2} - 1\right)$$
$$= \frac{1}{3}\left(-5 + 4\sqrt{2}\right)$$

24:

$$\int_0^6 \int_{y/2}^{y/3+5} f(x,y)\ dx\ dy$$

26:

$$\int_1^4 \int_{x/3-1/3}^{2} f(x,y)\ dy\ dx$$

44:

$$\int_0^1 \int_y^1 \sin(x^2)\ dx\ dy = \int_0^1 \int_0^x \sin(x^2)\ dy\ dx$$
$$= \int_0^1 x\sin(x^2)\ dx$$
$$= \frac{1}{2}\sin(1)$$

46:

$$\int_0^3 \int_{y^2}^9 y\sin(x^2)\ dx\ dy = \int_0^9 \int_0^{\sqrt{x}} y\sin(x^2)\ dy\ dx$$
$$= \frac{1}{2}\int_0^9 x\sin(x^2)\ dx$$
$$= \frac{1}{4}\sin(81)$$

16.3

2:

$$\int_0^1 \int_0^1 \int_0^2 ax + by + cz\ dz\ dy\ dz = \int_0^1 \int_0^1 2ax + 2by + 2c\ dy\ dx$$
$$= \int_0^1 2ax + b + 2c\ dx$$
$$= a + b + 2c$$

4:

$$\int_0^a \int_0^b \int_0^c e^{-x-y-z}\ dz\ dy\ dz = \int_0^a \int_0^b e^{-x-y-z}\left(e^{-c} - 1\right)\ dy\ dz$$
$$= \int_0^a e^{-x-y-z}\left(e^{-b} - 1\right)\left(e^{-c} - 1\right)\ dx$$
$$= \left(e^{-a} - 1\right)\left(e^{-b} - 1\right)\left(e^{-c} - 1\right)$$

6:

16: Positive.

18: Zero.

24: Zero.

26: Positive.

16.4

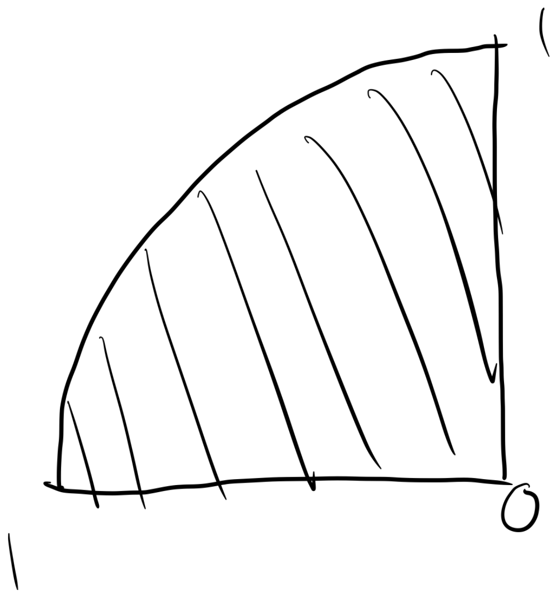
2:

$$\int_0^{\sqrt{2}} \int_0^{2\pi} f(r,\theta)r\ d\theta\ dr$$

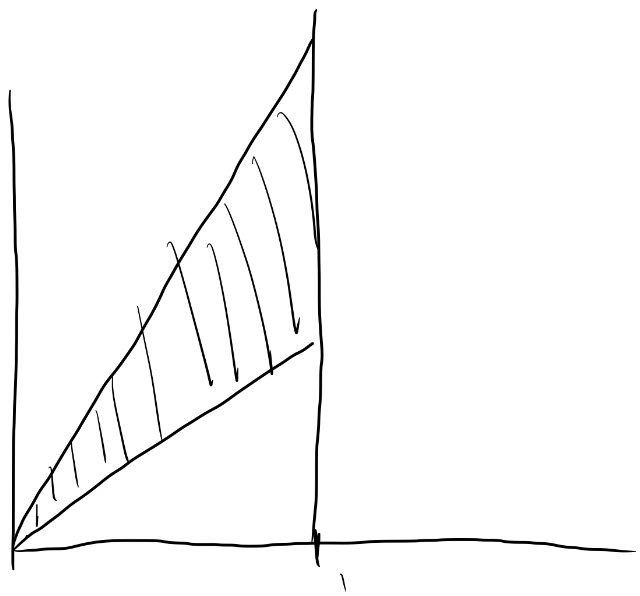
4:

$$\int_1^2 \int_{\pi/2}^{3\pi/2} f(r,\theta)r\ d\theta\ dr$$

10:



12:



16:

$$\begin{aligned}\int_R \sqrt{x^2+y^2}\ dx\ dy &= \int_0^{\pi/2}\int_2^3 r^2\ dr\ d\theta\\ &= \frac{1}{3}\int_0^{\pi/2} 19\ d\theta\\ &= \frac{19\pi}{6}\end{aligned}$$

20: I don't know how to do this problem.

32:

$$\int_0^{2\pi} d\theta \int_0^{\sqrt{8}} r dr \int_0^{8-r^2} dz = 2\pi \int_0^{\sqrt{8}} r\sqrt{8-r^2} dr$$
$$= \frac{32\sqrt{2}}{3}\pi$$

16.5

2:

$$A = \{r, \theta, z \mid r \in (-\infty, \infty),\ \theta = \pi/4,\ z \in (-\infty, \infty)\}$$

4:

$$z = r$$
$$r \in (0, \infty)$$
$$\theta \in [0, 2\pi)$$

6:

$$z = 10$$

8: (a) Cone and Sphere respectively.
(b) $z = r$ and $z^2 + r^2 = 1$
(c) An ice cream cone.
(d) $2r^2 = 1$
(e) $2(x^2 + y^2) = 1$

10:

$$\int_W f(x, y, z) = \int_{-3}^{1} \int_0^{2\pi} \int_0^1 \sin(r)\ dr\ d\theta\ dz$$
$$= 8\pi(1 - \cos 1)$$