5. $f(x,y) = x^2y - x + 2y + 3$ at $(1,2)$

$f_x \quad \frac{\partial}{\partial x} f(x,y) \quad 2xy - 1 \qquad 2(1)(2)-1=3$

$f_y \quad \frac{\partial}{\partial y} f(x,y) \quad x^2+2 \qquad 1^2+2=3$

7. $f(x,y) = \sin(y)\cos x$ at $(\pi/3, \pi/3)$

$f_x = \sin(y)(-\sin(x)) \qquad -\frac{3}{4}$

$f_y = \cos y \cos x \qquad \frac{1}{4}$

33. $f(x,y,z) = \frac{3x}{7y^2z} \qquad \frac{3x}{7z} \cdot y^{-2}$

$f_x = \frac{3}{7y^2z} \quad f_y = -\frac{6x}{7z} y^{-3}$

$f_z \quad \frac{3x}{7y^2} z^{-1} \qquad \frac{-3x}{7y^2} z^{-2}$

$f_{yz} = \frac{6x}{7} y^{-3} z^{-2}$

$f_{zy} = \frac{6x}{7} y^{-3} z^{-2}$

Let $f(x, y) = xy + e^y$. Find the signed volume under f on the region R, which is the rectangle with corners $(3, 1)$ and $(4, 2)$ pictured in Figure 13.2.3, using Fubini's Theorem and both orders of integration.

$$\int_1^2 \int_3^4 xy + e^y \, dx \, dy$$

$$\frac{x^2}{2} y + x(e^y) + C \Big|_3^4$$

$$\frac{16}{2} y + 4e^y + C$$

$$- \quad \frac{9}{2} y + 3e^y + C$$

$$= \frac{7}{2} y + e^y$$

$$\int_1^2 \frac{7}{2} y + e^y \, dy$$

$$\frac{7}{4} y^2 + e^y + C \Big|_1^2$$

$$\frac{7}{4} \cdot 4 + e^2 + C$$

$$- \quad \frac{7}{4} \cdot 1 + e + C$$

$$\boxed{\frac{21}{4} + e^2 - e}$$

6. $$\int_{-\pi/2}^{\pi/2}\int_{0}^{\pi} (\sin x \cos y)\ dx\, dy$$

$$-\cos x \cos y + C \Big|_0^{\pi}$$

$$\cos y + c$$
$$- \cos y + C$$
$$0$$

$$\int_{-\frac{\pi}{2}}^{\frac{\pi}{2}} 0 \ dy$$

$$0 + C \Big|_{-\frac{\pi}{2}}^{\frac{\pi}{2}}$$

$$C - C = 0$$

8. $$\int_{1}^{3}\int_{y}^{3} (x^2 y - xy^2)\ dx\, dy$$

$$\frac{x^3}{3} y - \frac{x^2}{2} y^2 + C \Big|_y^3$$

$$\frac{27}{3} y - \frac{9}{2} y^2 + C$$
$$-\left(\frac{y^3}{3} y - \frac{y^2}{2} y^2 + c\right) \quad 9y - 4.5y^2 + \frac{1}{6} y^4$$

$$\int_1^3 9y - 4.5y^2 + \frac{1}{6}y^4 \, dy$$

$$\frac{9}{2}y^2 - 1.5y^3 + \frac{1}{30}y^5 + C \Big|_1^3$$

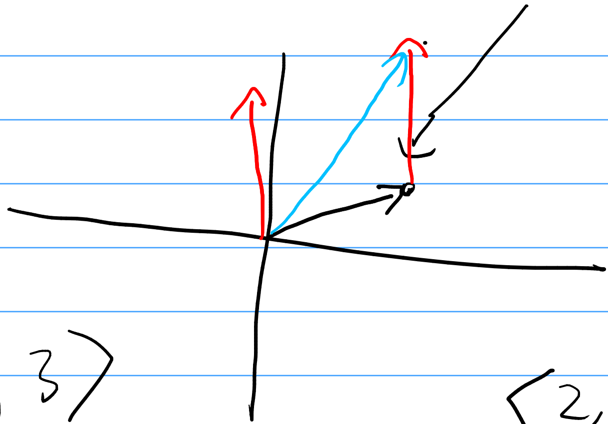
$$\cancel{\frac{81}{2}} - \cancel{\frac{81}{2}} + \frac{81}{10} \cancel{+C}$$

$$-\left(\frac{9}{2} - \frac{3}{2} + \frac{1}{30} \cancel{+C}\right)$$

$$8.1 - 3.0\overline{3} \qquad 5.0\overline{6}$$

Vectors!

$\langle 2, 1 \rangle$ $\qquad$ $(2, 1)$



$\langle -1, 3 \rangle$

$\langle 2, 1 \rangle + \langle -1, 3 \rangle$

$= \langle 1, 4 \rangle$

$\| \vec{v} \|$ $\qquad$ $\vec{v}\ \langle a, b \rangle$

$\sqrt{a^2 + b^2}$

$\| \langle 4, -3 \rangle \|$

$\sqrt{16 + 9} = \sqrt{25} = 5$

$\langle 4, 1 \rangle - \langle 0, -9 \rangle$

$= \langle 4, 10 \rangle$

$\langle 3, -1, 9 \rangle$

$\downarrow$

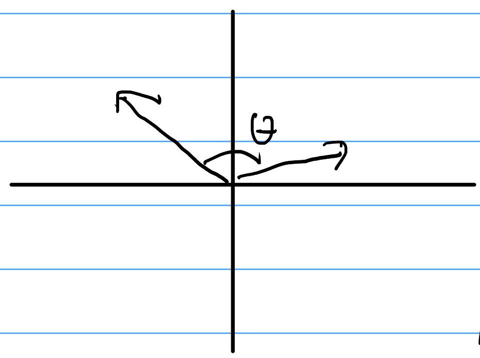
$\langle 2, 2, -4 \rangle$

$6 \quad -2 \quad -36 \quad = -32$

$\langle 3, -1, 9 \rangle \cdot \langle 2, 2, -4 \rangle = -32$

$\vec{v} \qquad\qquad \vec{u}$

$\langle 3, 1 \rangle \qquad \langle -4, 3 \rangle$ find angle



$-12 + 3 = -9$

$\vec{v} \cdot \vec{u} = -9$

$\|\vec{v}\| \quad \|\vec{u}\|$

$\sqrt{10} \qquad 5$

$5\sqrt{10} \cos\theta = -9$

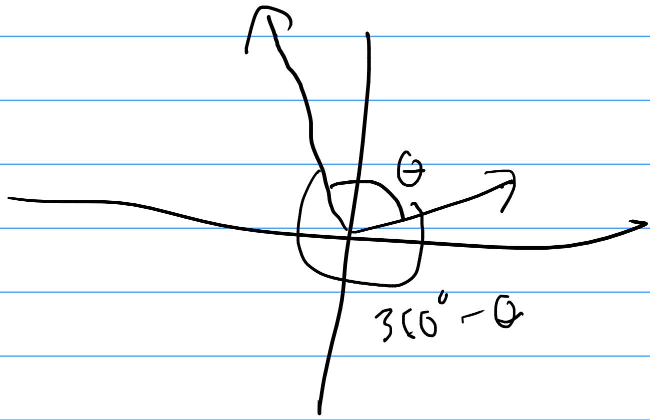
0.965 rad

$\cos\theta = \frac{-9}{5\sqrt{10}}$

$\theta = \cos^{-1}\left(\frac{9}{5\sqrt{10}}\right)$

$\langle 3, 1 \rangle \qquad \langle -2, 6 \rangle$

$-6 + 6 = 0$



Let $\vec{u} = \langle 1, 1, 1 \rangle$, $\vec{v} = \langle -1, 3, -2 \rangle$ and $\vec{w} = \langle -5, 1, 4 \rangle$

$\vec{u} \cdot \vec{v} = -1 + 3 - 2 = 0$

$\vec{u} \cdot \vec{w} = -5 + 1 + 4 = 0$

$\vec{v} \cdot \vec{w} = 5 + 3 - 8 = 0$

Let $\vec{u} = \langle 3, 5 \rangle$ and $\vec{v} = \langle 1, 2, 3 \rangle$.

1. Find two vectors in $\mathbb{R}^2$ that are orthogonal to $\vec{u}$.
2. Find two non–parallel vectors in $\mathbb{R}^3$ that are orthogonal to $\vec{v}$.

1. $3a + 5b = 0 \qquad -2 \cdot \langle -5, 3 \rangle$

$a = -5 \quad b = 3 \qquad \langle 10, -6 \rangle$

$\vec{v} = \langle 1, 2, 3 \rangle$

$\langle -3, -6, 5 \rangle$

$1a + 2b + 3c = 0$

$\langle -5, 1, 1 \rangle$

$-3 \quad -6 \quad 5$

$-5 + 2 + 3$

$-3 - 12 + 15 = 0$