1. $F'(P,\vec{v}) = -26$

3. a) $F'_x(-1,2) = -14,\ F'_y(-1,2) = 4$

   b) $F'_x(1,3) = -2,\ F'_y(1,3) = -3$

4. a) $F'_x(x,y) = \frac{x}{\sqrt{x^2 - y^2}},\ F'_y(x,y) = 6y - \frac{y}{\sqrt{x^2 - y^2}}$

   b) $F'_x(x,y) = \frac{2\sqrt{y^2 - x^2} + 2\frac{x^2}{\sqrt{y^2 - x^2}}}{y^2 - x^2}$

   $F'_y(x,y) = \frac{2xy}{\sqrt{(y^2 - x^2)^3}}$

   c) $F'_x(x,y,z) = \frac{5}{z}e^{\frac{x+y^2}{z}},\ F'_y(x,y,z) = \frac{10y}{z}e^{\frac{x+y^2}{z}},\ F'_z(x,y,z) = -\frac{5(x+y^2)}{z^2}e^{\frac{x+y^2}{z}}$

   d) $F'_u(u,v) = \frac{e^u}{e^{u+e^v}},\ F'_v(u,v) = \frac{e^v}{e^{u+e^v}}$

   e) $F'_u(u,v) = vu^{v-1},\ F'_v(u,v) = u^v \ln(u)$

   f) $F'_x(x,y) = -3y(3-x)^{3y-1},\ F'_y(x,y) = 3(3-x)^{3y}\ln(3-x)$

   g) $F'_x(x,y) = sen\ y\ e^{xsen\ y},\ F'_y(x,y) = xcosy\ e^{xsen\ y}$

   h) $F'_s(s,u,v) = -u^3 sen\left(\frac{s}{v}\right).\frac{1}{v},\ F'_u(s,u,v) = 3u^2 cos\left(\frac{s}{v}\right),\ F'_v(s,u,v) = \frac{su^3}{v^2}\text{sen}\left(\frac{s}{v}\right)$

   i) $F'_x(x,y) = \frac{2}{2x+y},\ F'_y(x,y) = \frac{1}{2x+y}$

6. a) $\nabla F(1,-1) = \left(-\frac{19}{6}, 0\right)$

   b) $\nabla F(-1,2) = (-12,9)$

   c) $\nabla F(1,1,1) = (2,2,3)$

8. a) $F'(P,\vec{v}) = -6+\frac{\sqrt{3}}{2}$ b) $F'(P,\breve{v}) = \frac{2}{\sqrt{5}}$ c) $F'(P,\breve{v}) = -\frac{23}{\sqrt{50}}$

9. (Respuesta parcial) a) $F'_{max}(P) = \sqrt{2},\ F'_{min}(P) = -\sqrt{2}$

   b) $F'_{max}(P) = \sqrt{50},\ F'_{min}(P) = -\sqrt{50}$

   c) $F'_{max}(P) = \sqrt{241},\ F'_{min}(P) = -\sqrt{241}$

   d) $F'_{max}(P) = 3,\ F'_{min}(P) = --3$

   e) $G'_{max}(P) = \sqrt{2}, G'_{min}(P) = -\sqrt{2},\ \breve{V}_{nula} = (\frac{\sqrt{2}}{2}, \frac{\sqrt{2}}{2})$ o $\breve{V}_{nula} = (-\frac{\sqrt{2}}{2}, -\frac{\sqrt{2}}{2})$

   f) $H'_{max}(P) = \sqrt{17}, H'_{min}(P) = -\sqrt{17},$

10. Comenzará a rodar en la dirección $\left(\frac{-80}{\sqrt{11584}}, \frac{-72}{\sqrt{11584}}\right)$- Debe caminar en la dirección $\left(\frac{80}{\sqrt{11584}}, \frac{72}{\sqrt{11584}}\right)$

11. En la dirección dada por $\left(\sqrt{\frac{1}{2}}, \sqrt{\frac{1}{2}}, 0\right)$.

12. Debe nadar en la dirección dada por el vector $\left(\frac{4}{11}, 1\right)$. La profundidad no cambia en la dirección $\left(-1, \frac{4}{54}\right)$

13. $\left(\frac{1}{\sqrt{5}}, 0, \frac{2}{\sqrt{5}}\right)$

14.

a)

$$F''_{xx}(x,y) = \frac{(-x^2+y^2)}{(x^2-y^2)^2} \quad F''_{xy}(x,y) = \frac{2xy}{(x^2-y^2)^2},$$

$$F''_{yy}(x,y) = \frac{(x^2-y^2)}{(x^2-y^2)^2}$$

b)

$$F''_{xx}(x,y) = 9y(y-1)(3x)^{y-2}$$
$$F''_{xy}(x,y) = 3(3-x)^{y-1} + 3y(3x)^{y-1}\ln(3x)$$
$$F''_{yy}(x,y) = \ln^2(3z).(3x)^{y-1}$$

c)

$$F''_{xx}(x,y) = -\frac{y^2}{x^2}, \quad F''_{xy}(x,y) = \frac{2y}{x}, \quad F''_{yy}(x,y) = 2\ln(xy) + 3$$

d) $F''_{xx}(x,y,z) = 0 = F''_{xy}(x,,y,z) = F''_{xz}(x,y,z)$

$$F''_{yy}(x,y,z) = -6yz, F''_{yz}(x,y,z) = -3y^2, \quad F''_{zz}(x,y,z) = 16$$