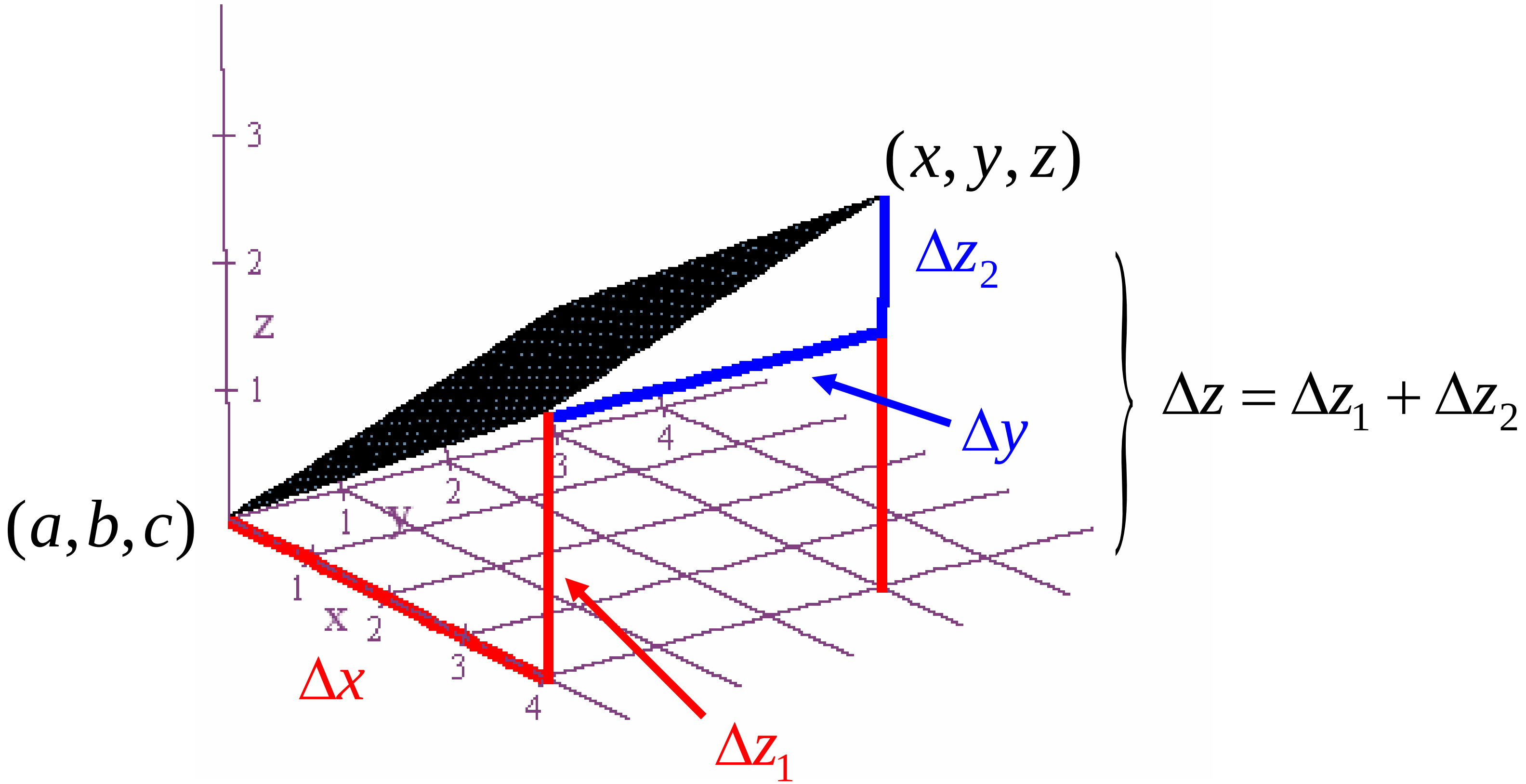
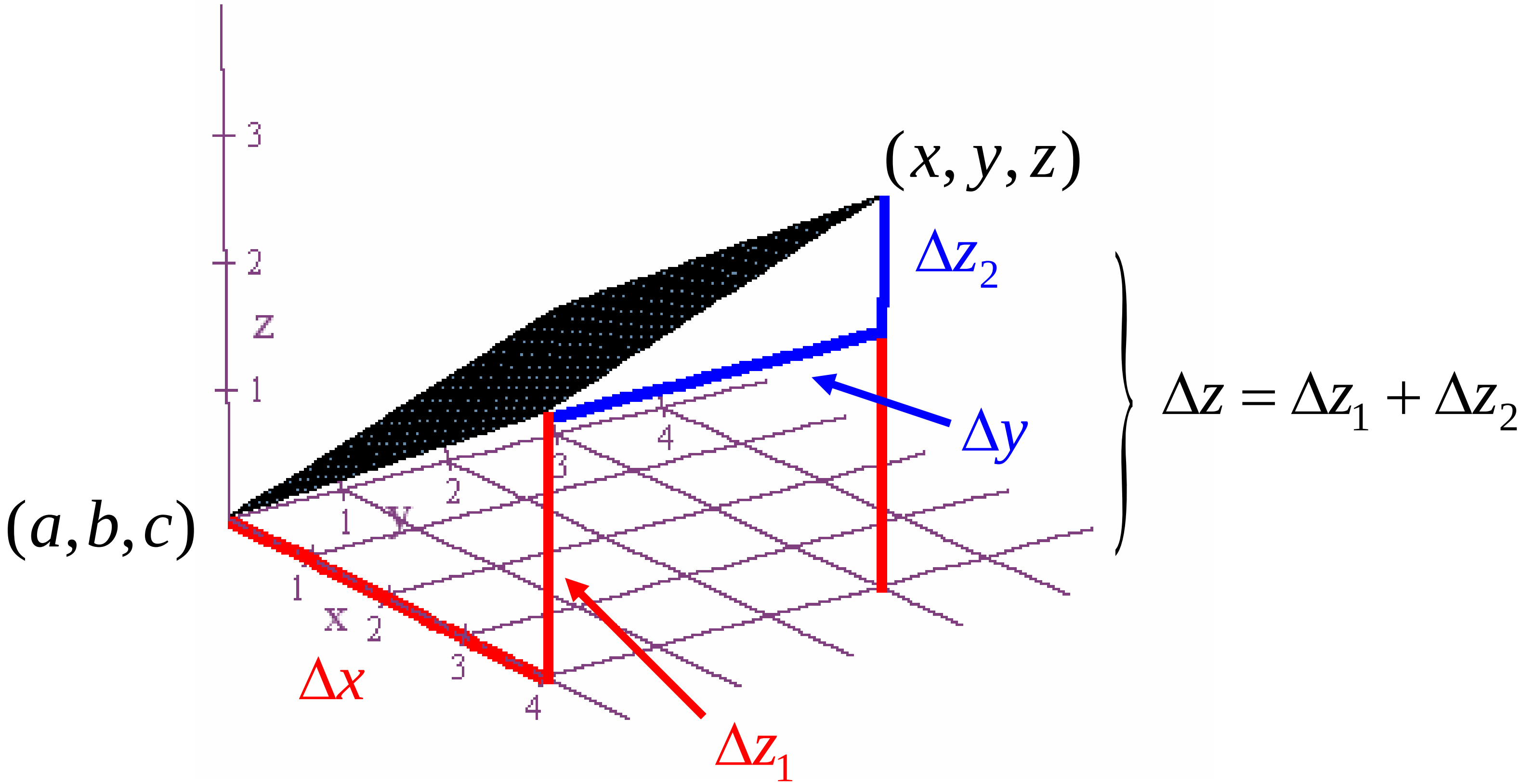
Partial Derivatives and Tangent Planes



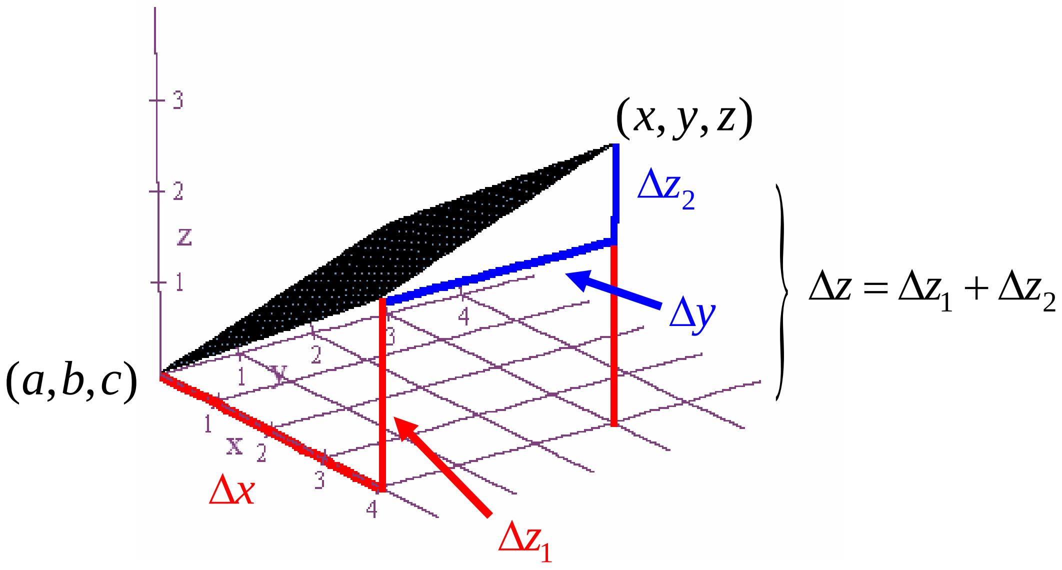
Recall how we first found an equation for a plane.



$$z - c = \Delta z = \Delta z_1 + \Delta z_2 = m_x(x-a) + m_y(y-b)$$

$$z = m_x(x-a) + m_y(y-b) + c$$

If this is a tangent plane at a point *(a,b,c)* on the surface graph of *z=f(x,y)*, then we can make the following substitutions:



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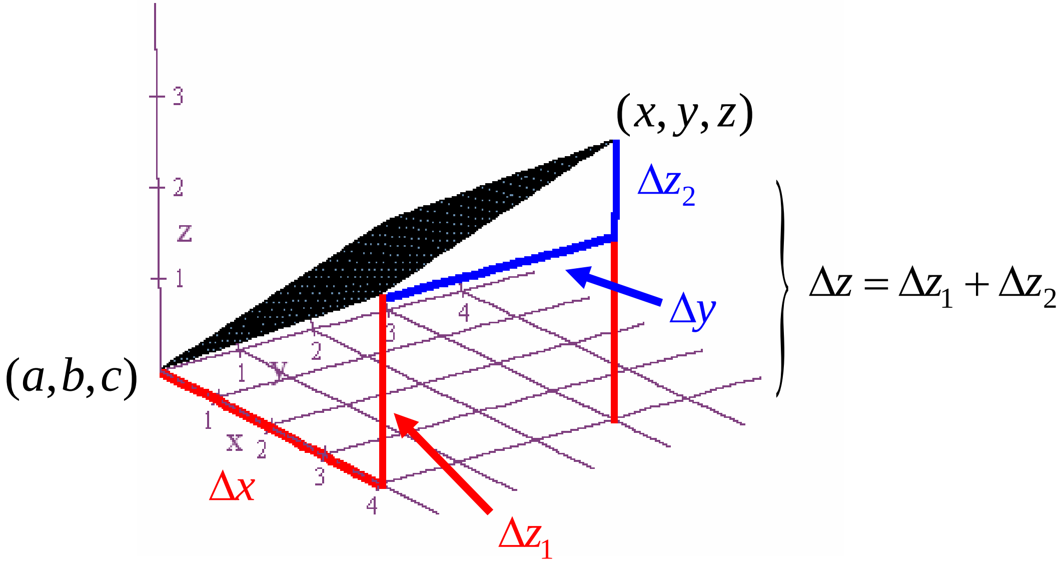

$$m_x = z_x(a,b) = \frac{\partial f(a,b)}{\partial x}$$

$$z - c = \Delta z = \Delta z_1 + \Delta z_2 = m_x(x-a) + m_y(y-b)$$

$$z = m_x(x-a) + m_y(y-b) + c$$

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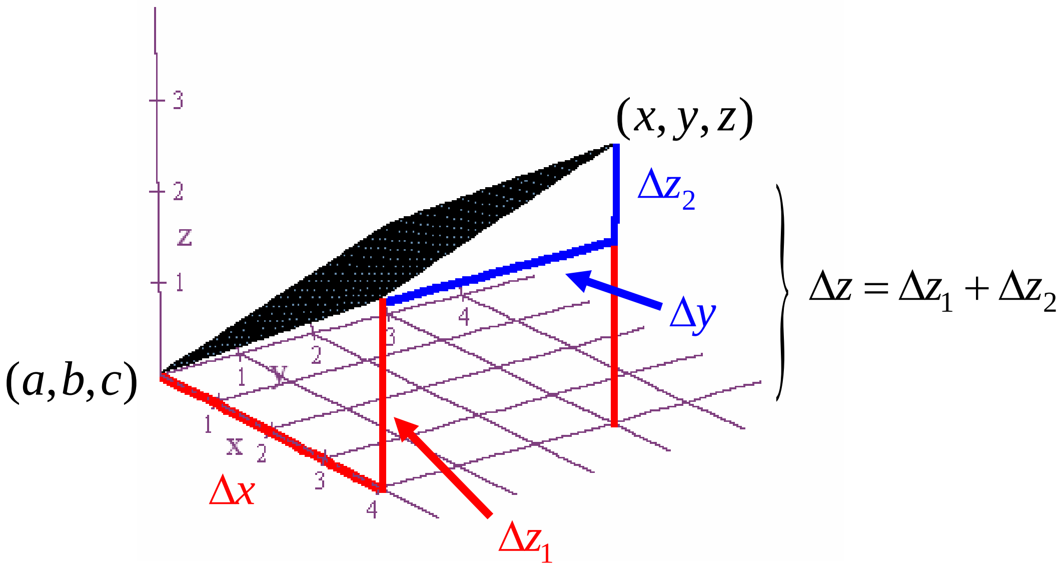

$$m_x = z_x(a,b) = \frac{\partial f(a,b)}{\partial x}$$

$$m_y = z_y(a,b) = \frac{\partial f(a,b)}{\partial y}$$

$$z - c = \Delta z = \Delta z_1 + \Delta z_2 = m_x(x-a) + m_y(y-b)$$

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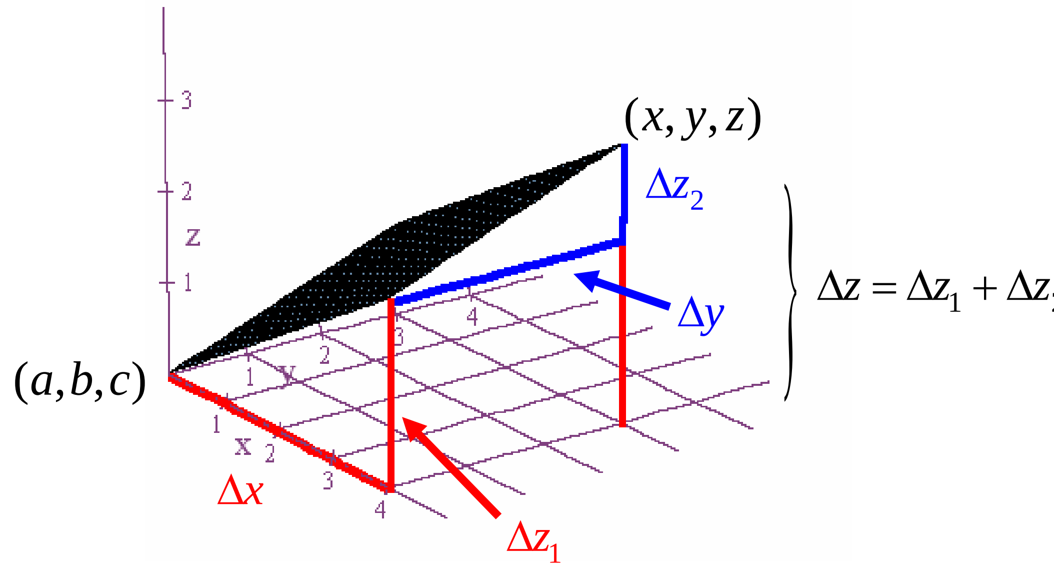
If this is a tangent plane at a point *(a,b,c)* on the surface graph of *z=f(x,y)*, then we can make the following substitutions:



$$m_x = z_x(a,b) = \frac{\partial f(a,b)}{\partial x}$$

$$m_y = z_y(a,b) = \frac{\partial f(a,b)}{\partial y}$$

$$c = f(a,b)$$

$$z - c = \Delta z = \Delta z_1 + \Delta z_2 = m_x(x-a) + m_y(y-b)$$

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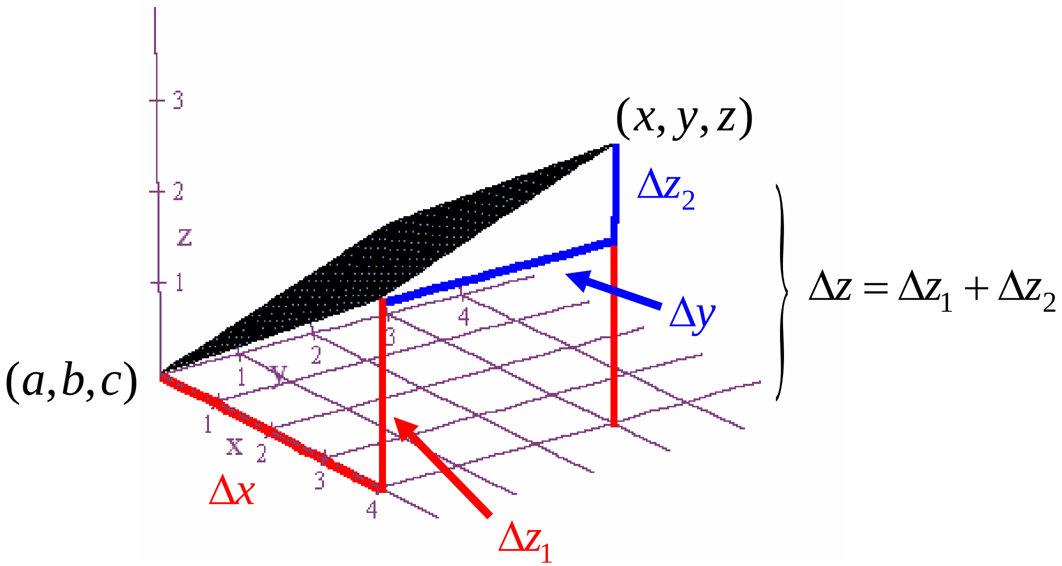


$$m_x = z_x(a,b) = \frac{\partial f(a,b)}{\partial x}$$

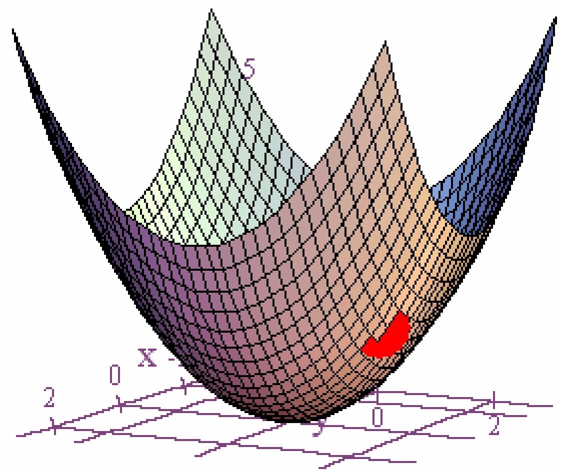
$$m_y = z_y(a,b) = \frac{\partial f(a,b)}{\partial y}$$

$$c = f(a,b)$$

$$z = \frac{\partial f(a,b)}{\partial x}(x-a) + \frac{\partial f(a,b)}{\partial y}(y-b) + f(a,b)$$

$$z = \frac{\partial f(a,b)}{\partial x}(x-a) + \frac{\partial f(a,b)}{\partial y}(y-b) + f(a,b)$$

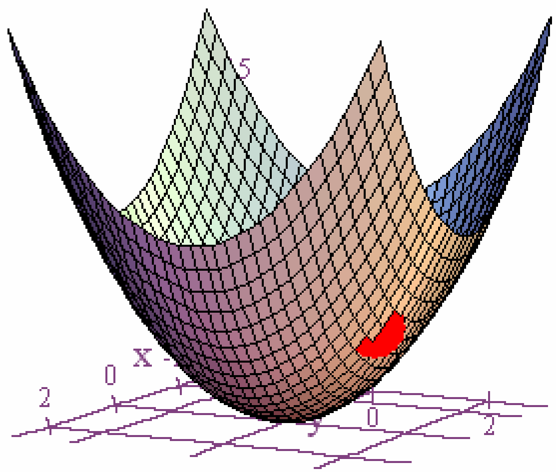
Find the tangent plane to $z = x^2 + y^2$ at the point $(1,2,5)$.



$$z = \frac{\partial f(a,b)}{\partial x}(x-a) + \frac{\partial f(a,b)}{\partial y}(y-b) + f(a,b)$$

Find the tangent plane to $z = x^2 + y^2$ at the point $(1, 2, 5)$.

$$z_x = 2x$$

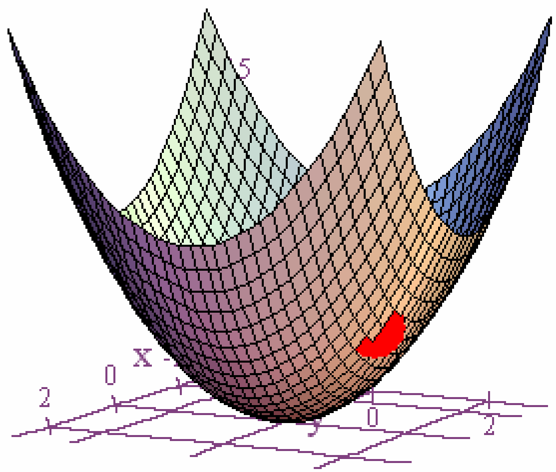


$$z = \frac{\partial f(a,b)}{\partial x}(x-a) + \frac{\partial f(a,b)}{\partial y}(y-b) + f(a,b)$$

Find the tangent plane to $z = x^2 + y^2$ at the point $(1,2,5)$.

$$z_x = 2x$$

$$z_x(1,2) = 2$$



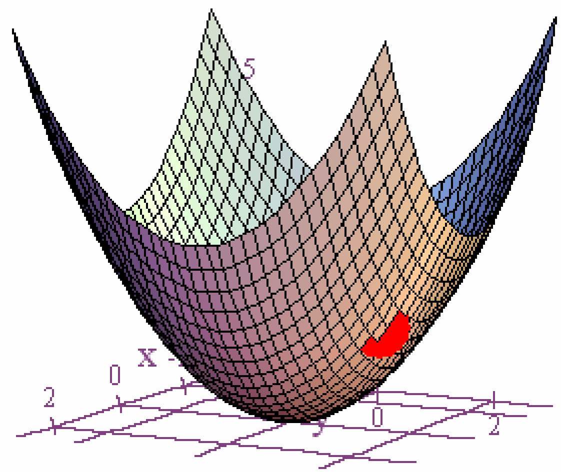
$$z = \frac{\partial f(a,b)}{\partial x}(x-a) + \frac{\partial f(a,b)}{\partial y}(y-b) + f(a,b)$$

Find the tangent plane to $z = x^2 + y^2$ at the point $(1,2,5)$.

$$z_x = 2x$$

$$z_x(1,2) = 2$$

$$z_y = 2y$$



$$z = \frac{\partial f(a,b)}{\partial x}(x-a) + \frac{\partial f(a,b)}{\partial y}(y-b) + f(a,b)$$

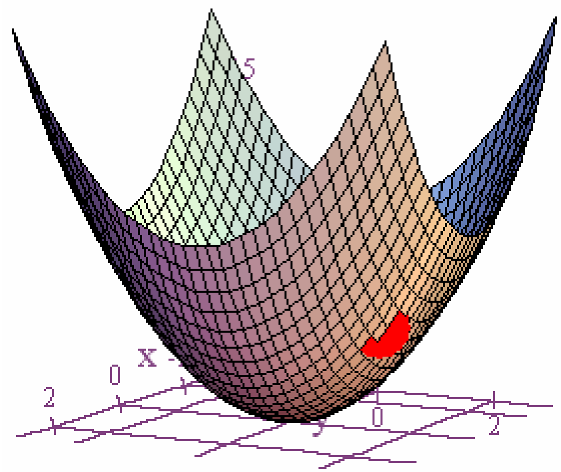
Find the tangent plane to $z = x^2 + y^2$ at the point $(1, 2, 5)$.

$$z_x = 2x$$

$$z_x(1,2) = 2$$

$$z_y = 2y$$

$$z_y(1,2) = 4$$



$$z = \frac{\partial f(a,b)}{\partial x}(x-a) + \frac{\partial f(a,b)}{\partial y}(y-b) + f(a,b)$$

Find the tangent plane to $z = x^2 + y^2$ at the point $(1,2,5)$.

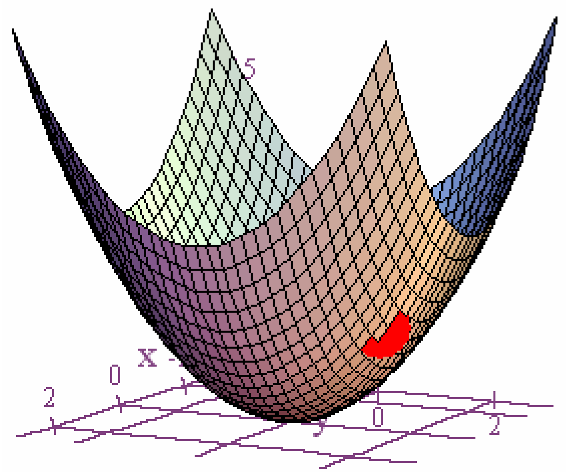
$z_x = 2x$

$z_x(1,2) = 2$

$z_y = 2y$

$z_y(1,2) = 4$

$z(1,2) = 5$



$$z = \frac{\partial f(a,b)}{\partial x}(x-a) + \frac{\partial f(a,b)}{\partial y}(y-b) + f(a,b)$$

Find the tangent plane to $z = x^2 + y^2$ at the point $(1,2,5)$.

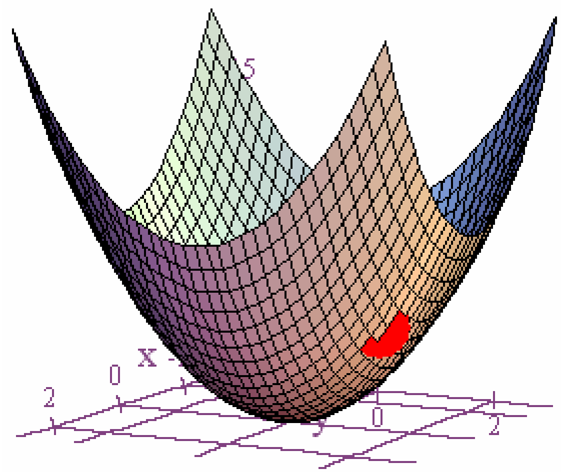
$z_x = 2x$

$z_x(1,2) = 2$

$z_y = 2y$

$z_y(1,2) = 4$

$z(1,2) = 5$



$$z = 2(x-1) + 4(y-2) + 5$$

$$\Rightarrow z = 2x + 4y - 5$$

$$z = \frac{\partial f(a,b)}{\partial x}(x-a) + \frac{\partial f(a,b)}{\partial y}(y-b) + f(a,b)$$

Find the tangent plane to $z = x^2 + y^2$ at the point $(1,2,5)$.

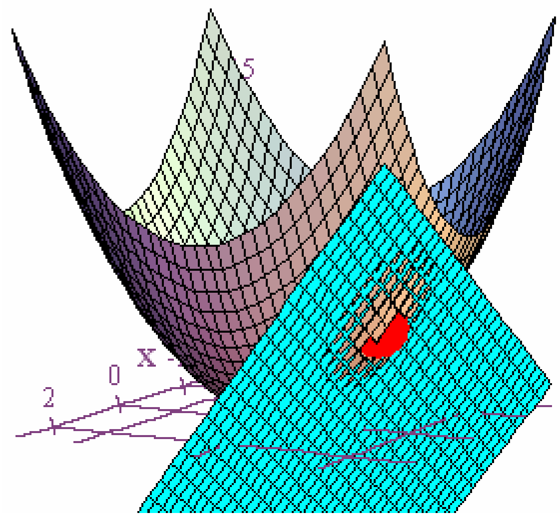
$$z_x = 2x$$

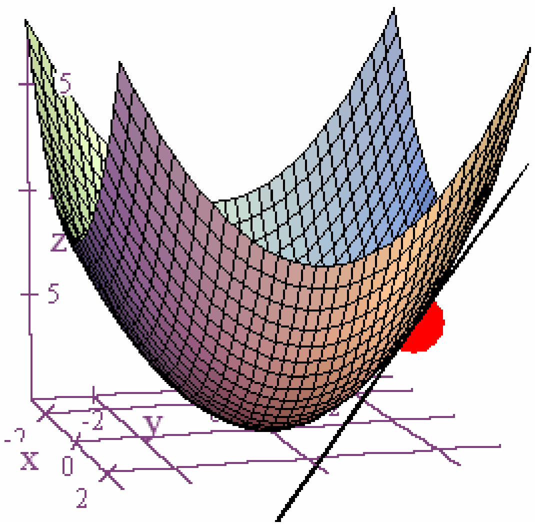
$$z_x(1,2) = 2$$

$$z_y = 2y$$

$$z_y(1,2) = 4$$

$$z(1,2) = 5$$





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