Calculus 3 Workbook

Tangent planes and normal lines

krista king
MATH

EQUATION OF THE TANGENT PLANE

■ 1. Find a tangent plane to the surface $f(u, v, w) = 0$ at $(3, -1, 5)$.

$$f(u, v, w) = \ln \frac{u^2 + 1}{v^2 w^5}$$

■ 2. Find any tangent planes to the surface $f(x, y, z) = 0$ that are parallel to the plane $5x - 4y + 2z + 5 = 0$.

$$f(x, y, z) = x^3 - 4y^2 + z^2 + 2x + 12y + 5$$

■ 3. Find a line of intersection of the xy-plane and tangent plane to the surface $f(x, y, z) = 0$ at $(\pi, -1, \sqrt{6})$.

$$f(x, y, z) = 2\cos(x + \pi)(y^2 + y + 5) - 3z^3$$

■ 4. Find and identify the set of the points where the tangent plane to the surface $f(x, y, z) = 0$ is parallel to z-axis.

$$f(x, y, z) = x^2 + 4y^2 + z^2 + 2x - 8y + 8z + 17 = 0$$

NORMAL LINE TO THE SURFACE

■ 1. Use the gradient vector to find a symmetric equation of the normal line to the curve $f(s,t) = 0$ at $(-3,3)$, where

$$f(s,t) = t2^{2t+s-3}$$

■ 2. Use the gradient vector to find a vector equation of the normal line to the surface $f(x,y,z) = 0$ at $(0,-5,1)$.

$$f(x,y,z) = \frac{2x - y^2}{z}$$

■ 3. Use the gradient vector to find a parametric equation of the normal line to the surface $f(x,y,z) = 0$ at $(2,-3,0)$.

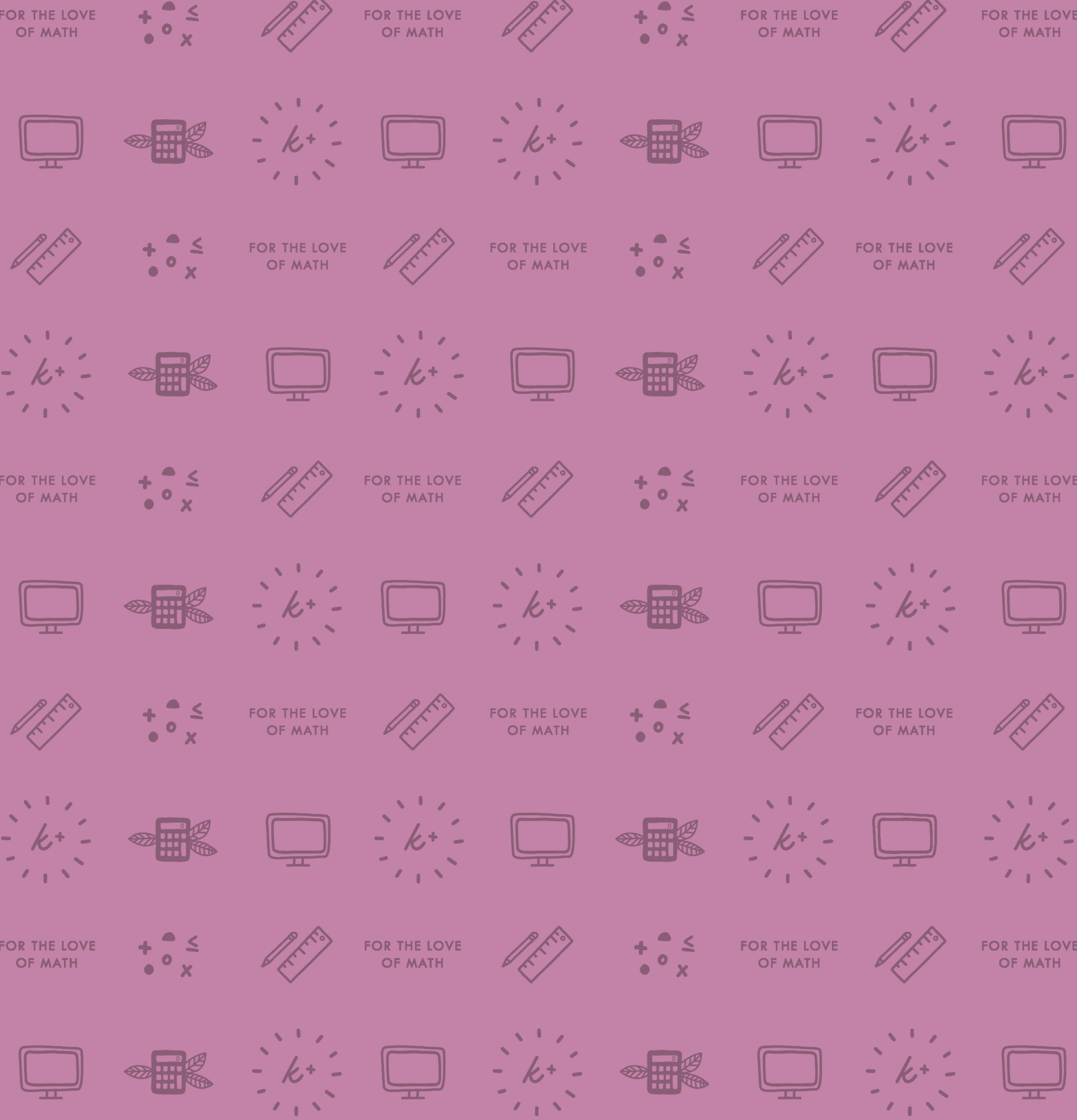
$$f(x,y,z) = 3x^3 - 2xyz - 2y^2 + 5yz + 1$$

■ 4. Use the gradient vector to find a parametric equation of the normal line to the surface $f(x,y,z) = 0$ that's parallel to the line $r = \langle 2,17,-6\rangle + t\langle 9,1,-6\rangle$.

$$f(x,y,z) = 2x^2 + y^2 + 3z^2 - 3x - 5y + 5$$

■ 5. Use the gradient vector to find a vector equation of the normal line to the surface $f(x, y, z) = 0$ that's perpendicular to the plane $x + 4y - 8z + 12 = 0$.

$$f(x, y, z) = ye^{2x+6} + z^2 - 5$$



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