Calculus 3 Workbook

Curl and divergence

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CURL AND DIVERGENCE OF A VECTOR FIELD

■ 1. Find the set of points in R^3 where the curl of the vector field $\vec{F}(x, y, z)$ is parallel to the vector $\vec{a} = \langle 2, 1, 2 \rangle$.

$$\vec{F}(x, y, z) = \left\langle \frac{z}{2}, \ln(xyz), z^2 \right\rangle$$

■ 2. Find the set of points in R^3, where the divergence of the vector field $\vec{F}(x, y, z) = \langle x^3 + 12xy, y^3 + 3z^2y - 9y, 3z^2 - 6xz \rangle$ is 0.

■ 3. Find the maximum value of the divergence of the vector field $\vec{F}(x, y, z)$.

$$\vec{F}(x, y, z) = \langle \ln(x^2 + 4), -e^{y+2}, -z\,e^{-y} - z^3 \rangle$$

POTENTIAL FUNCTION OF THE CONSERVATIVE VECTOR FIELD, THREE DIMENSIONS

■ 1. Find the potential function of the conservative vector field.

$$\vec{F}(x,y,z) = \left\langle \frac{2x}{z}, \frac{1}{z}, -\frac{x^2+y}{z^2} \right\rangle$$

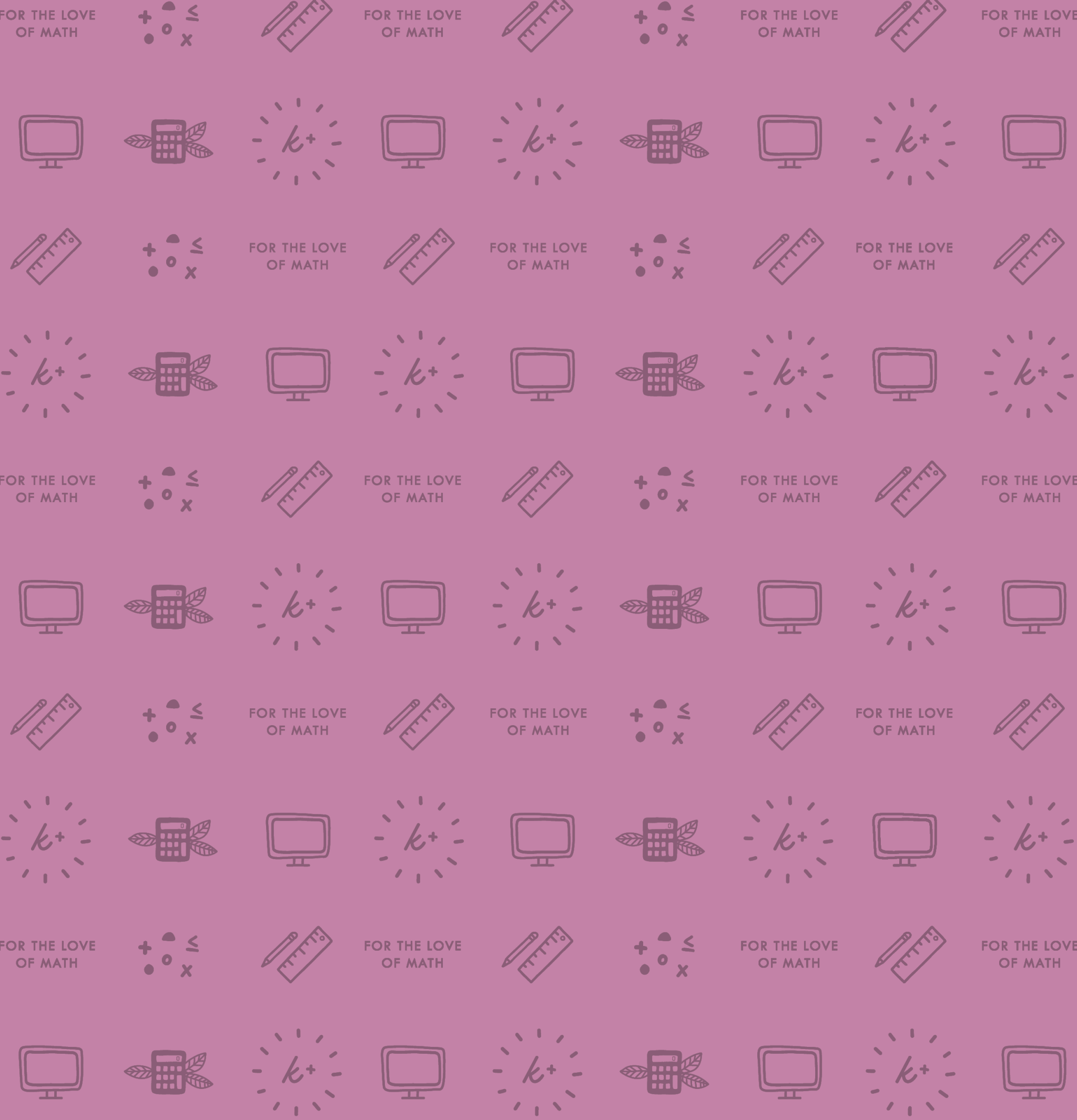
■ 2. Find the value of a such that the vector field $\vec{F}$ has a potential function, then find that potential function.

$$\vec{F}(x,y,z) = \langle 4x^a y^3 z^2, 3x^4 y^2 z^2, 2x^4 y^3 z \rangle$$

■ 3. Find a potential function of the conservative vector field $\vec{F}(x,y,z)$, then use this function to calculate the line integral of $\vec{F}$ over the curve $\vec{r}(t)$ between the parameter values $t = -2$ and $t = 2$.

$$\vec{F}(x,y,z) = \langle 2(x+1), 2(z-y), 2(y-1) \rangle$$

$$\vec{r}(t) = \left\langle e^{t^2-4}, \sin\frac{\pi t}{4}, e^{-t^2+4} \right\rangle$$



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