Calculus 3 Workbook

Velocity and acceleration

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VELOCITY AND ACCELERATION VECTORS

■ 1. Find the value of t such that the velocity of the vector function $\vec{r}(t)$ is 0.

$$\vec{r}(t) = \langle 4t^3 - 5t^2 - 28t, 2e^{t-1} + e^{-2t+5}, \cos(\pi t) \rangle$$

■ 2. Find the point on the curve such that the velocity along the x-axis reaches its maximum value.

$$\vec{r}(t) = \left\langle \frac{t}{t^2+2}, 3\tan(3t^2), \ln 2t \right\rangle$$

■ 3. Find the values of the parameters p and q such that the absolute value of acceleration of the non-constant function $\vec{r}(t) = \langle p \sin 3t, 4 \cos qt \rangle$ is a constant for any value of t.

VELOCITY, ACCELERATION, AND SPEED, GIVEN POSITION

■ 1. Find the point where the speed is 0, given the position function.

$$\vec{r}(t) = \left\langle \ln(2t^2 + 8t + 50), t^4 + 32t + 17, \arctan t - \frac{t}{5} \right\rangle$$

■ 2. Find the interval(s) of t values where the acceleration along the z-axis is negative for the position function.

$$\vec{r}(t) = \langle 2\sin(2t), e^{t^2+1}, t^4 - 10t^3 - 36t^2 - 5t + 45 \rangle$$

■ 3. Find the velocity, speed, and acceleration of the position function at the point(s) where the trajectory intersects the xy-plane.

$$\vec{r}(t) = \langle \sin 4t, 2\cos(t + \pi), 2 + 2\sin t \rangle, \text{ where } t \in [0,2\pi]$$

VELOCITY AND POSITION GIVEN ACCELERATION AND INITIAL CONDITIONS

■ 1. Find the velocity and position of the acceleration function $\vec{a}(t) = \langle 4\sin^2 t, -\cos t \rangle$ if $\vec{r}(\pi) = \langle -2,1 \rangle$, and $\vec{v}(\pi) = \langle 0,0 \rangle$.

■ 2. Find the speed function given the acceleration function $\vec{a}(t) = \langle 4t^3 - 1, 6t^2 + 2t, 2e^{2t} \rangle$ if $\vec{v}(0) = \langle 1, -3,1 \rangle$.

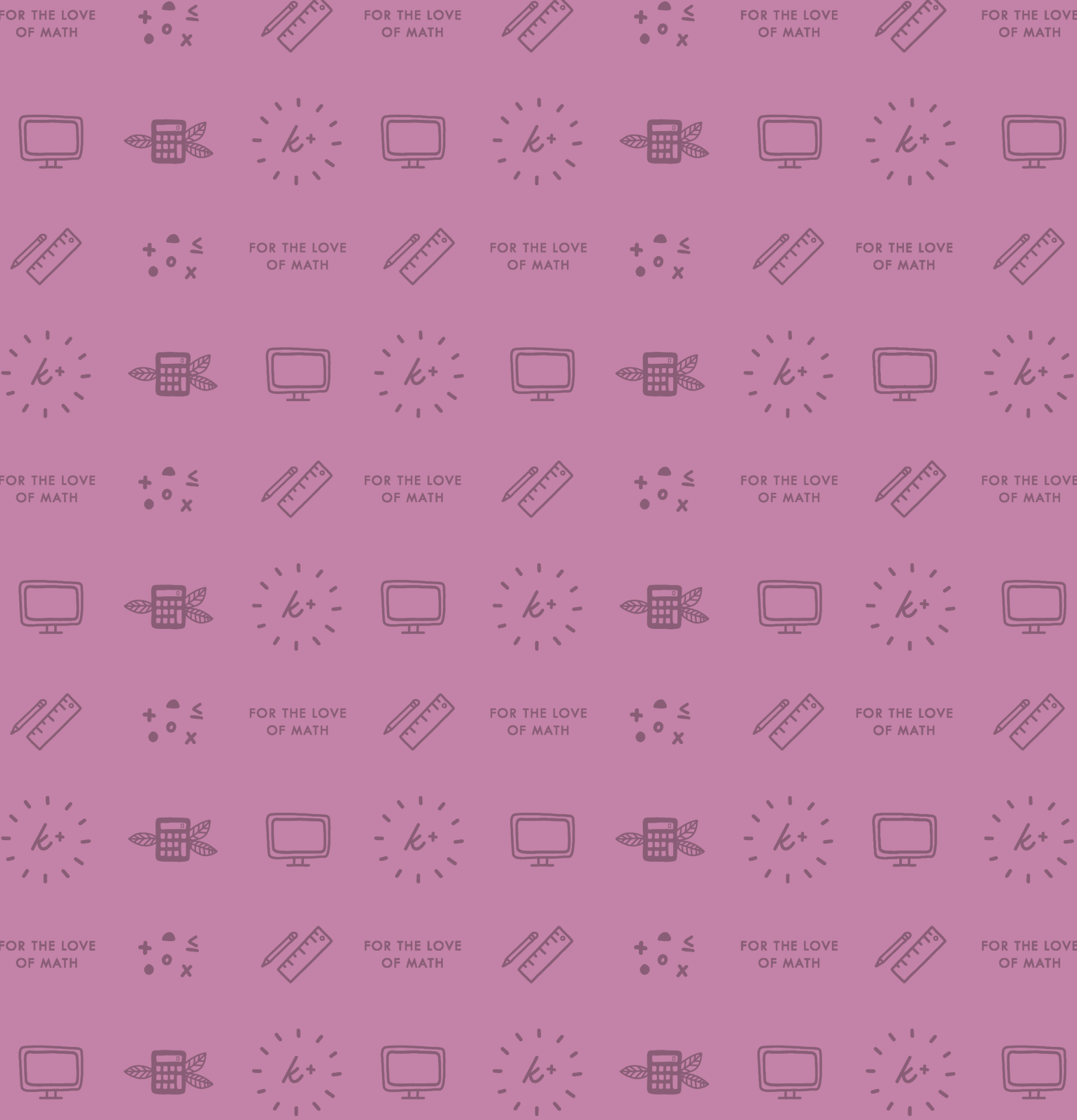
■ 3. Find the distance travelled by a particle during the first 10 seconds, given its acceleration function $\vec{a}(t) = \langle 2\sin t, 2\cos t \rangle$, where t is the time in seconds and the initial velocity is $\vec{v}(0) = \langle -2,0 \rangle$.

TANGENTIAL AND NORMAL COMPONENTS OF ACCELERATION

■ 1. Find the tangential and normal components of acceleration for the vector function $\vec{r}(t) = \langle e^{2t} + 1, e^{-2t} - 1, t - 4 \rangle$ at the point $(2,0,-4)$.

■ 2. Find the point(s) where the tangential component of acceleration for the vector function $\vec{r}(t) = \langle 2\cos t - 2, 3\sin t + 5, 4t - 1 \rangle$ is 0.

■ 3. Find the values of parameters p and q, such that the normal components of acceleration for $\vec{r}(t) = \langle 2t^2, 3pt, t^2 - 4t + qt \rangle$ are 0 at the origin.



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