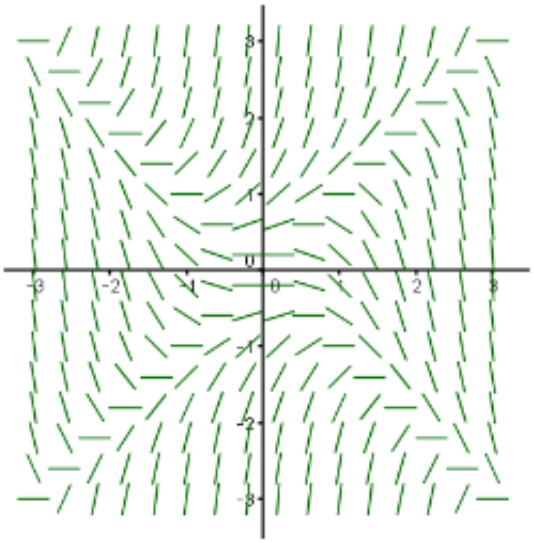
# Direction fields and Euler's method

## Group work:

**Problem 1** (a) *The following is a direction field for the differential equation* $\frac{dy}{dx} = y^2 - x^2$.




*Sketch the solution such that* $y\left(\frac{1}{2}\right) = 1$.

(b) *Use Euler's Method to give a numerical estimate to the solution of the differential equation* $y' = y^2 - t^2$ *at* $y(2)$ *that goes through the point* $\left(\frac{1}{2}, 1\right)$. *Use* $\Delta t = 0.5$.

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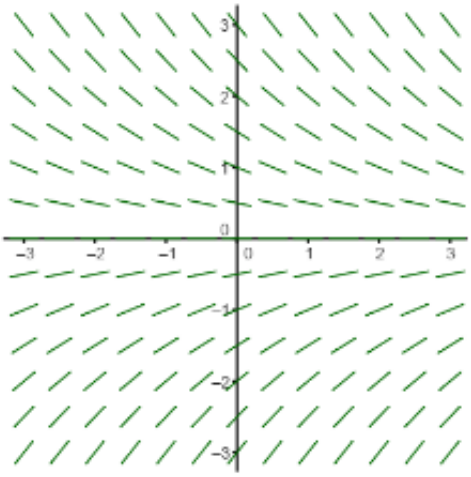
**Problem 2** *Describe why the following direction field could be the direction field for the differential equation*

$$\frac{dy}{dt} y\cos(t)$$

*but* ***not*** *for*

$$\frac{dy}{dt} = y\sin(t) \qquad \text{or} \qquad \frac{dy}{dt} = t\cos(y).$$




**Problem 3** *Match each of the following differential equations with a corresponding direction field (if it is present):*

*i.* $y' = \dfrac{t}{2+y}$

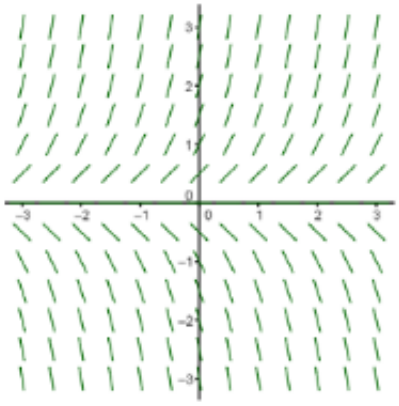
*ii.* $y' = \cos(t+y)$

*iii.* $y' = 1 + y^2$

*iv.* $y' = ty$

b.

b.



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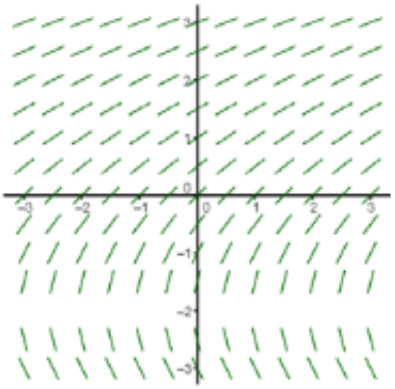

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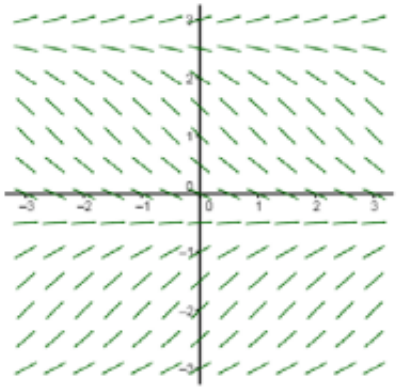

**Problem 4** *Which of the following are separable differential equations? For those that are, solve them, assuming that* $y(4) = 5$.

(a) $y' = x^2 + y^2$

(b) $y' = x + xy^2$

(c) $y' = e^{2x-y}$