MATH2130: Ordinary Differential Equations

Self-Assessment Sheet 2: Direction Fields and Separable Equations

1.) Find the solution of the following differential equation:

$$\frac{\mathrm{d}y}{\mathrm{d}x} \;=\; k \cdot \frac{f'(x)}{f(x)}$$

where $f(x) \neq 0$ for all x. *For the solution, click on the following space:*

2.) Comment on the following initial value problem:

$$\frac{\mathrm{d}y}{\mathrm{d}x} \;=\; \frac{1}{x}, \qquad y(0) = 0.$$

For the solution, click on the following space:

3.) On Exercise sheet 1, Question 4(i), we have looked at the initial value problem $x(t) \cdot x'(t) + t = 0$ and $x(t_0) = 0$. The solution we have obtained there are (we actually got two!) $x(t) = \pm\sqrt{t_0^2 - t^2}$, i.e., the half-circles centered at the origin of radius $|t_0|$ either above or below the t-axis.
Are these really the solutions of this differential equation? *For the solution, click on the following space:*

Please turn over!

4.) Are the following differential equations separable?
Click on "Evaluate" after you have ticked those that are separable.

◯ $(t^2 + y^2)\, y' \;=\; -2\, t\, y$

◯ $y' \;=\; x/y$

◯ $T' \;=\; k \cdot (T - T_0)$

◯ $a\,\dot{x} + b\,x \;=\; c$ where $a \neq 0$, $b \neq 0$ and c are constants.

◯ $a\,\dot{x} + b\,x \;=\; c(t)$ where $a \neq 0$, $b \neq 0$ are constants and c is a function of t.

◯ $y' \;=\; (y^2 + 1)$

Evaluate