1. **(1 point)** `Library/maCalcDB/setDiffEQ4Linear1stOrder/ur_de_4_10.pg`

A. Let $g(t)$ be the solution of the initial value problem

$$\frac{dy}{dt} + 7y = 0,$$

with $y(0) = 1$.
Find $g(t)$.
$g(t) =$ ______.

B. Let $f(t)$ be the solution of the initial value problem

$$\frac{dy}{dt} + 7y = \exp(3t)$$

with $y(0) = 1/10$.
Find $f(t)$.
$f(t) =$ ______.

C. Find a constant c so that

$$k(t) = f(t) + cg(t)$$

solves the differential equation in part B and $k(0) = 12$.
$c =$ ______.

2. **(1 point)** `Library/AlfredUniv/diffeq/linear/duiller.pg`
According to Ince [pg. 531] the first known use of integrating factors to solve a differential equation was by Fatio de Duiller in June of 1687. He was solving the equation

$$3xdy - 2ydx = 0$$

which we would write in standard form (using the prime notation) as

______ = ___.

For this equation the integrating factor is: ______
After multiplying both sides by the integrating factor and unapplying the product rule we get the new differential equation:

$$\frac{d}{dx}[\ \_\_\_\_\_\_\ ] = \_\_\_\_\_\_$$

Integrating both sides we get the algebraic equation ______ = ______
Solving for y, the solution to the differential equation is y = ______ (using C as the constant)

[Ince] Ince E L, Ordinary Differential Equations, Longmans, Green and Co, London, 1927.

3. **(1 point)** `Library/WHFreeman/Rogawski_Calculus_Early_Transcendentals_Second_Edition/9_Introduction_to_Differential_Equations/9.1_Solving_Differential_Equations/9.1.39.pg`

Solve the initial value problem $t^2\frac{dy}{dt} - t = 1 + y + ty$, $y(1) = 1$.
$y =$ ______

4. **(1 point)** `Library/FortLewis/DiffEq/1-First-order/04-Linear-integrating-factor/KJ-2-2-37.pg`

(1) Find the solution to the initial value problem

$$\frac{y' - e^{-t} + 3}{y} = -3, \quad y(0) = 3.$$

______ help (equations)

(2) Discuss the behavior of the solution $y(t)$ as t becomes large. Does $\lim_{t\to\infty} y(t)$ exist? If the limit exists, enter its value. If the limit does not exist, enter *DNE* .

$\lim_{t\to\infty} y(t) =$ ______ help (numbers)