

Advanced Macroeconomics

2014/15 Winter term

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Tutorial 1: Maths Review

1. A reminder on maths

a. Compute derivatives of the following functions

$$h(x) = f(x)g(x)$$

$$h(x) = \frac{f(x)}{g(x)}$$

$$h(x) = f(g(x))$$

$$h(x) = x^n$$

$$h(x) = \frac{1}{f(x)}$$

$$h(x) = e^{f(x)}$$

$$h(x) = \ln f(x)$$

$$h(x) = \int_{a(x)}^{b(x)} f(x, t) dt$$

b. Compute integrals of the following functions

$$h(x) = \int a dx$$

$$h(x) = \int x^n dx$$

$$h(x) = \int \frac{1}{x} dx$$

$$h(x) = \int e^x dx$$

$$h(x) = \int a^x dx$$

- c. Compute the expressions for the growth rates of the following functions (i.e. find $\frac{\dot{x}(t)}{x(t)}$)

$$x(t) = y(t)z(t)$$

$$x(t) = \frac{y(t)}{z(t)}$$

$$x(t) = y(t)^n$$

- d. Find the general solution to the following first-order linear differential equation

$$\dot{y}(t) + a(t)y(t) = b(t)$$

2. Optimisation problems

Find the solution to the following optimisation problems:

$$\max U = xy$$

$$s.t.: P = 2x + 4y$$

$$\max U = x + (1 - y)x$$

$$s.t.: P = x + 3y$$