# Mathematics Self-Test, Economics Program

## *Instructions:*

The mathematics self-test is intended to help you determine whether you need to review or refresh your math skills before starting the program.

- Spend a maximum of 30 minutes on the test.
- This is a self-test, and the only person you deceive by using aids is yourself, so be as honest as possible.

If you get answers wrong or feel uncertain about one or several topics covered, we recommend reviewing those topics. To help, we have included chapter references to the following books:

- Sydsaeter, K. & Hammond, P. *Essential Mathematics for Economic Analysis*. Prentice Hall. Latest edition. Mainly chapters 1–4. Used in the Mathematical Economics II course in semester 3.

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Note: Round to two decimals.

**Chapters 2+3 (Sydsaeter & Hammond)**

1. Compute the following exactly (without decimals):

a) $\frac{\frac{2}{3}}{3}$, b) $\frac{5}{4}\cdot\frac{1}{2}$, c) $\frac{1}{3}/\frac{7}{6}$

2. Suppose rent is linked to inflation. The rent for a 2-room apartment is 3,500 SEK and inflation is expected to be 1.7%. What is the expected rent increase?

3. Solve the following equations:

a) $200 = 1,5x + 3$, b) $-45 = 0,75x$

4. Compute the following sum: $\sum_{j=0}^{3} 2^j + 1$

**Chapters 2+3 (Sydsaeter & Hammond)**

5. Find the positive solution to the following equations:

a) $x^3 = 10$, b) $x^{-8} = 20000$, c) $x^{15} = \frac{1}{3}$

6. Oil prices increased by a total of 18% over an 8-month period. What is the monthly growth rate (in %)?

7. Solve the following equation: $3x^2 - 5x + 3 = 1$

**Chapters 2+3+4 (Sydsaeter & Hammond)**

8. State the intercept and slope of the lines $y(x)$:
a) $2y + 5x + 6 = 0$, b) $4y - 7x + 9 = 0$

9. Suppose demand is given by $p = 25 - 0,3q$ (p=price, q=quantity) och and supply is given by $p = 0,1q$. Find the equilibrium price and quantity, i.e. supply = demand.

10. Solve the following equations:
a) $\ln x = 0,5$, b) $e^{0,5x} = 2$, c) $5000 \cdot 1,04^x = 8000$

**Chapters 6+7+8 (*+11) (Sydsaeter & Hammond)**

11. If the marginal tax rate in your municipality is 33.4%, how much extra tax will you pay if your salary increases by 500 SEK?

12. Compute the derivative of the following functions:
a) $f(x) = 10$, b) $f(x) = 2x$, c) $f(x) = x^2 + 2x + 1$,

13. Compute the derivative of the following functions:
a) $f(x) = \ln x$, b) $f(x) = e^x$, c) $f(x) = \sqrt{x}$

14. Compute the derivative of the following functions:
a) $y = 1 - e^{-3x}$, b) $f(x) = \ln(1 + x^2)$, c) $f(x) = \dfrac{1+x}{1-x}$

15. Determine whether the following functions are increasing or decreasing for $x > 0$:
a) $f(x) = x^2$, b) $f(x) = 1/x$, c) $f(x) = \sqrt{x}$

16. Find all local extrema of the following functions:
a) $f(x) = x^2 - 10x$, b) $f(x) = 5 - 2x + x^2$, c) $y = -x^2 + \ln x$

Advanced – but useful:
*17. Is the function $f(x) = \sqrt{x}$ convex or concave?
*18. Find the partial derivative $\dfrac{\partial f}{\partial L}$ for $f(L,K) = L^{\alpha}K^{\beta}$.

# Answer Key for the Diagnostic Test

1. a) $\frac{2}{9}$, b) $\frac{5}{8}$, c) $\frac{6}{21}$

2. Rent increase = 59.50 SEK/month

3. a) 131.33, b) -60

4. 19

5. a) 2.15, b) 0.29, c) 0.93

6. 2.1% per month

7.

8. a) Intercept = -3, Slope = -2.5
b) Intercept = 1,75, Slope = -2.25

9. Equilibrium price = 6.25 and equilibrium quantity = 62.5

10. a) 1.64, b) 1.39, c) 11.98

11. 167 SEK

12. a) 0, b) 2 c) 2x+2

13. a) $\frac{1}{x}$, b) $e^x$, c) $\frac{1}{2\sqrt{x}}$

14. a) $3e^{-3x}$, b) $\frac{2x}{(1+x^2)}$, c) $\frac{-2}{(1-x)^2}$

15. a) Increasing, b) Decreasing, c) Increasing

16. a) $x = 5$ is a minimum, b) $x = 1$ is a minimum, c) $x = \sqrt{0,5} \approx 0,71$ is a maximum

17. Concave

18. $\alpha L^{\alpha-1} K^{\beta}$