

## Multiple choice 1 in EBA2910<sup>1</sup> - Mathematics for Business Analytics

10 December 2021

The exam has 15 multiple choice problems. Right answer gives 3 points, wrong answer gives -1 points, answer (E) gives 0 points. Only one answer is right.

### Problem 1

We have the cost function  $C(x) = x^2 + 20x + 1600$  where  $x$  is the number of produced units. Which statement is correct?

- (A) Cost optimum is 160.
- (B) Cost optimum is 100.
- (C) The minimal average unit cost is 100.
- (D) The minimal average unit cost is 40.
- (E) I choose not to answer this problem.

### Problem 2

Every month for 15 years you deposit 5 000 into a bank account with 3.6% nominal interest and monthly compounding. First deposit is made today. 18 years from now the account balance will be

- (A)  $5\,000 + 5\,000 \cdot 1.036 + 5\,000 \cdot 1.036^2 + \dots + 5\,000 \cdot 1.036^{214} + 5\,000 \cdot 1.036^{215}$
- (B)  $5\,000 \cdot 1.003^{216} + 5\,000 \cdot 1.003^{215} + 5\,000 \cdot 1.003^{214} + \dots + 5\,000 \cdot 1.003^{38} + 5\,000 \cdot 1.003^{37}$
- (C)  $5\,000 + \frac{5\,000}{1.003} + \frac{5\,000}{1.003^2} + \dots + \frac{5\,000}{1.003^{178}} + \frac{5\,000}{1.003^{179}}$
- (D)  $5\,000 + 5\,000 \cdot 1.003 + 5\,000 \cdot 1.003^2 + \dots + 5\,000 \cdot 1.003^{178} + 5\,000 \cdot 1.003^{179}$
- (E) I choose not to answer this problem.

### Problem 3

Which statement is not correct?

- (A) If  $f(x) = \ln(x)$  then  $f'(0.5) = 2$
- (B) If  $f(x) = \frac{x}{1-x}$  then the equation  $f'(x) = 0$  has no solutions
- (C) If  $f(x) = xe^x$  then  $f'(-1) = 0$
- (D) If  $f(x) = \sqrt{x}$  then  $f'(0.25) = 2$
- (E) I choose not to answer this problem.

### Problem 4

We have a hyperbola function  $f(x)$  with vertical asymptote  $x = 30$  and horizontal asymptote  $y = 80$ . In addition we have  $f(20) = 90$ . Which statement is correct?

- (A)  $f(40) = 40$
- (B)  $f(40) = -90$
- (C)  $f(40) = 70$
- (D)  $f(30) = 80$
- (E) I choose not to answer this problem.

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<sup>1</sup>Exam code EBA29102, arranged as home exam

### Problem 5

Hege considers an investment proposal where a payment of  $K$  today will give the following back payments:

Year	3	4	5
Payment	12	21	26

Suppose the internal rate of return should be 15%. Which statement is correct?

- (A)  $K$  is in the interval  $[0, 32]$
- (B)  $K$  is in the interval  $[32, 45]$
- (C)  $K$  is in the interval  $[45, 58]$
- (D)  $K$  is in the interval  $[58, \rightarrow)$
- (E) I choose not to answer this problem.

### Problem 6

In figure 1 you see the graph of  $f(x)$ .

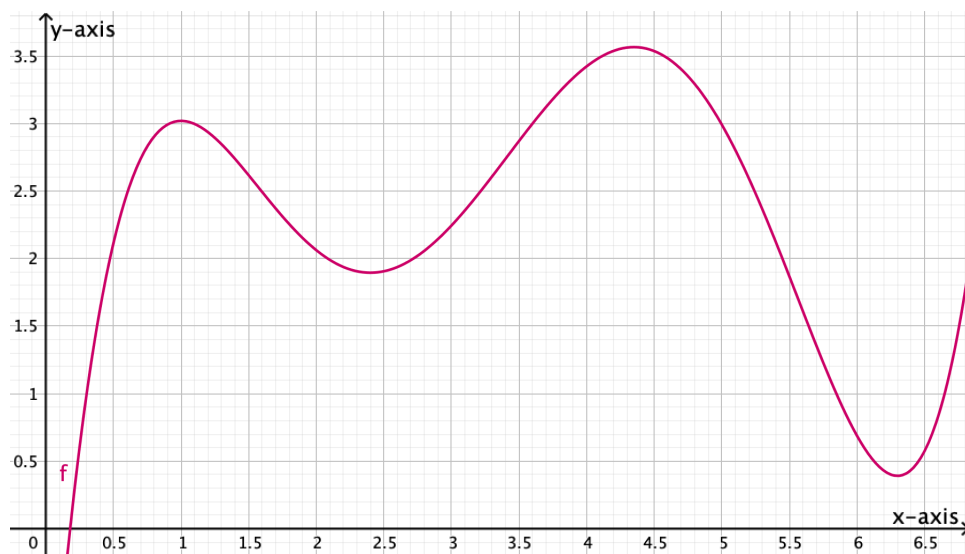


Figure 1: The graph of  $f(x)$

Which statement is not correct?

- (A)  $f(2) > f(5.5)$
- (B)  $f'(2) > f'(5)$
- (C)  $f'(x)$  is decreasing in the interval  $[4, 5]$ .
- (D)  $f''(x)$  is positive in the whole interval  $[3, 4]$ .
- (E) I choose not to answer this problem.

### Problem 7

We have the function  $f(x) = e^x - 2x$ . Which statement is correct?

- (A)  $f(x)$  is concave on the whole number line.
- (B)  $f(x)$  is convex on the whole number line.
- (C)  $f(x)$  is concave in the interval  $\langle \leftarrow, 0 \rangle$  and convex in the interval  $[0, \rightarrow)$ .
- (D)  $f(x)$  is concave in the interval  $\langle \leftarrow, \ln(2) \rangle$  and convex in the interval  $[\ln(2), \rightarrow)$ .
- (E) I choose not to answer this problem.

**Problem 8**

We have the function  $f(x) = 100 - (x + 5)^2$  with domain of definition  $D_f = [0, 3]$ . Then  $f(x)$  has an inverse function  $g(x)$  with domain of definition  $D_g$ . Which statement is correct?

- (A)  $D_g = [36, 75]$
- (B)  $D_g = \langle \leftarrow, 100 \rangle$
- (C)  $D_g = [100, \rightarrow)$
- (D)  $D_g = [75, 100]$
- (E) I choose not to answer this problem.

**Problem 9**

The inequality  $xe^x \leq 5x$  has the solutions

- (A)  $x$  is a number in the interval  $[0, \ln(5)]$
- (B)  $x \leq 0$  or  $x \geq \ln(5)$
- (C)  $x$  is a number in the interval  $\langle \leftarrow, \ln(5) \rangle$
- (D)  $x$  is a number in the interval  $[\ln(5), \rightarrow)$ .
- (E) I choose not to answer this problem.

**Problem 10**

A contract offers 15 000 paid every month without end date (forever). The first payment is 20 years from now. The nominal interest is 4.8% and it is monthly compounding. The present value of this contract is

- (A) between 0 and 1 444 355
- (B) between 1 444 355 and 3 764 999
- (C) between 3 764 999 and 10 000 000
- (D) more than 10 million.
- (E) I choose not to answer this problem.

**Problem 11**

We have a function  $f(x)$  which is the composition of two functions  $u(x)$  and  $g(x)$ , that is  $f(x) = g(u(x))$ . We know some of the function value tables:

$x$	-1	3	35
$u(x)$	3	1	3
$x$	3	35	50
$u'(x)$	-0.2	0.5	10

$x$	1	3	35
$g(x)$	50	-1	1
$x$	-0.2	3	35
$g'(x)$	6	4	-5

Which statement is correct?

- (A)  $f'(35) = -2.5$
- (B)  $f'(35) = -1.2$
- (C)  $f'(35) = 2$
- (D)  $f'(35) = 5$
- (E) I choose not to answer this problem.

**Problem 12**

Which statement is correct?

- (A) If  $f'(x) = (e^x - 10)(x^2 + 5)$  then  $f(x)$  has no stationary points.
- (B) If  $f'(x) = (2x - 5)\ln(x^2 - 14x + 50)$  then  $f(x)$  has two stationary points.
- (C) If  $f'(x) = \ln(x) - 2021$  then  $f(x)$  has no stationary points.
- (D) If  $f'(x) = x \ln(x) - \ln x$  then  $f(x)$  has two stationary points.
- (E) I choose not to answer this problem.

### Problem 13

We have a function  $f(x)$  with second derivative function  $f''(x)$  which has the following graph:

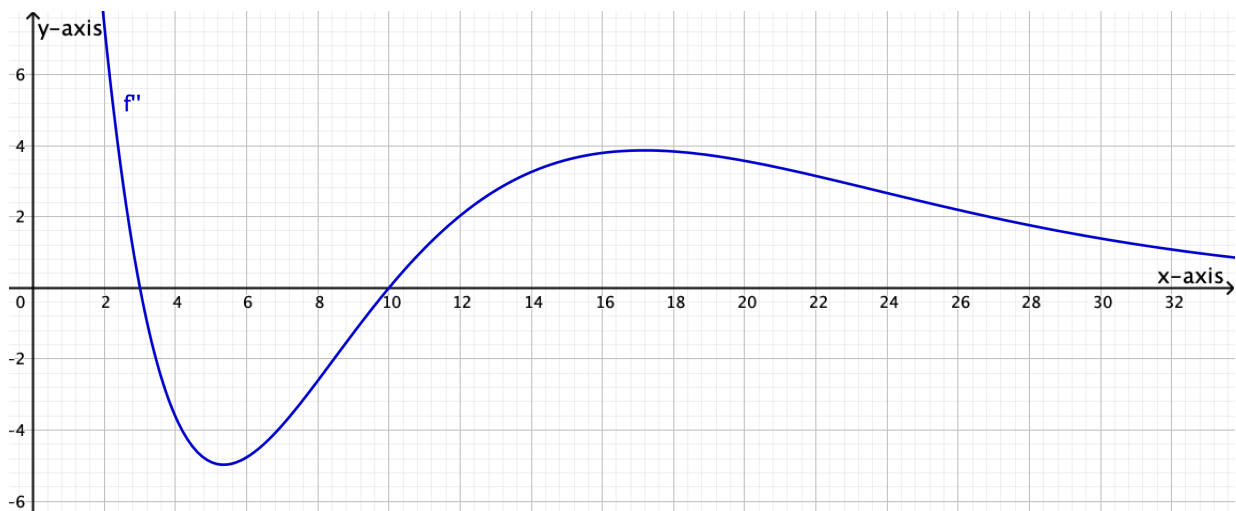


Figure 2: The graph of  $f''(x)$

Which statement is correct?

- (A)  $f(x)$  has exactly one inflection point in the interval  $[2, 16]$ .
- (B)  $f'(x)$  is strictly increasing in the interval  $[8, 16]$ .
- (C)  $f'(14)$  is the minimum value for  $f'(x)$  in the interval  $[14, 32]$ .
- (D)  $f(x)$  is concave in the interval  $[18, 24]$ .
- (E) I choose not to answer this problem.

### Problem 14

Suppose  $a$  is an undetermined number (a parameter). Which statement is not correct?

- (A) If  $\lim_{x \rightarrow 0} \frac{3x}{e^{ax} - 1} = 6$  then  $0 < a < 0.75$ .
- (B) If  $\lim_{x \rightarrow 0} \frac{\ln(ax + 1)}{2x} = 5$  then  $6 \leq a \leq 11$ .
- (C) If  $\lim_{x \rightarrow 3} \frac{4x - 12}{\sqrt{x + 1}} + ax = 12$  then  $2\sqrt{3} \leq a \leq 4\sqrt{2}$ .
- (D) If  $\lim_{x \rightarrow 1} \frac{\ln(x) - x + 1}{x^2 - 2x + a} = -0.5$  then  $0 \leq a < 1$ .
- (E) I choose not to answer this problem.

### Problem 15

We have a curve implicitly given by the equation  $x^2 - 3xy + y^2 = -5$ . Which statement is correct?

- (A) The curve has two points with  $x = 7$  and the product of the slopes of the tangents in these two points is  $\frac{8}{9}$ .
- (B) The curve has two points with  $x = 7$  and the slopes of the tangents in these two points are both negative.
- (C) The curve has one point with  $x = 7$  and the tangent in this point passes through  $(1, 2)$ .
- (D) The curve has two points with  $x = 7$  and the product of the slopes of the tangents in these two points is  $\frac{98}{51}$ .
- (E) I choose not to answer this problem.