

Mathematics

3 Points — Third Questionnaire

Instructions for examinees

א. Duration of the exam: Two hours

ב. Exam structure and breakdown of points:

This exam has six questions in the topic areas:

Algebra and Differential and Integral Calculus.

You must answer four questions –

$$4 \times 25 = 100 \text{ points}$$

ג. Material that may be used during the exam:

(1) A non-graphing calculator. You may not use the programming options of a programmable calculator. Use of a graphing calculator or the programming options may lead to the disqualification of the exam.

(2) Formula sheets (attached)

(3) A Hebrew-foreign language / foreign language-Hebrew dictionary

ד. Special instructions:

(1) Do not copy the question; only indicate the number of the question you are answering.

(2) Start each answer on a new page. Write the steps of the solution in your answer booklet, even when the calculations are done with a calculator. Explain all of your work, including calculations, in detail and in a clear and organized fashion. Lack of detail may lower your score or disqualify the exam.

(3) For draft paper, use the answer booklet or paper you receive from the proctors. Use of other draft paper may lead to the disqualification of the exam.

מתמטיקה

3 יחידות לימוד – שאלון שלישי

הוראות לנבחן

א. משך הבחינה: שעותיים.

ב. מבנה השאלון ומפתח ההערכה:

בשאלון זה שש שאלות בנושאים:

אלגברה, חשבון דיפרנציאלי ואינטגרלי.

עליך לענות על ארבע שאלות –

$$25 \times 4 = 100 \text{ נקודות}$$

ג. חומר עזר מותר בשימוש:

(1) מחשבון לא גרפי. אין להשתמש באפשרויות התכנות במחשבון הניתן לתכנות.

שימוש במחשבון גרפי או באפשרויות התכנות במחשבון עלול לגרום לפסילת הבחינה.

(2) דפי נוסחאות (מצורפים).

(3) מילון עברי-לועזי/לועזי-עברי.

ד. הוראות מיוחדות:

(1) אל תעתיק את השאלה; סמן את מספרה בלבד.

(2) התחל כל שאלה בעמוד חדש. רשום במחברת את שלבי הפתרון, גם כאשר החישובים מתבצעים בעזרת מחשבון.

הסבר את כל פעולותיך, כולל חישובים, בפירוט ובצורה ברורה ומסודרת.

חוסר פירוט עלול לגרום לפגיעה בציון או לפסילת הבחינה.

(3) לטייטה יש להשתמש במחברת הבחינה או בדפים שקיבלת מהמשגיחים.

שימוש בטייטה אחרת עלול לגרום לפסילת הבחינה.

הערה: קישורית לדוגמאות תשובה לשאלון זה

תתפרסם בדף הראשי של אתר משרד החינוך.

Good Luck!

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בהצלחה!

/המשך מעבר לדף/

Questions

Note! Explain all of your work, including calculations, clearly and in detail.
 Lack of detail may lower your score or lead to the disqualification of the exam.

Answer four of the questions 1-6 (each question – 25 points).

Note! If you answer more than four questions, only the first four answers in your answer booklet will be graded.

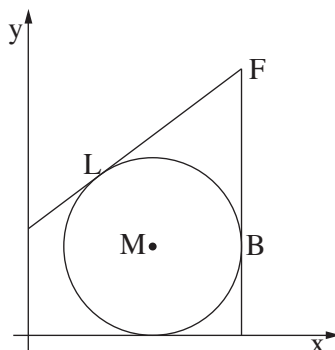
Algebra

- Each month, a factory worker receives a fixed base salary and a fixed bonus. The worker's total monthly paycheck is 6,600 shekels.
 One month, the factory owner increased the worker's base salary (for the month) by 15% and decreased the fixed bonus by 10%.
 After these changes, the worker's total monthly paycheck was 7,440 shekels.
 What was the worker's base salary before the changes?

- Given: a circle with the equation $(x - 7)^2 + (y - 5)^2 = 25$ and the center M.

A line is drawn that is a tangent to the circle at Point L, at which $x = 4$, as shown in the figure.

- Find the slope of ML.
 (The y-coordinate of L is greater than 1.)
- Find the equation of the tangent at Point L.



The line $x = 12$ is a tangent to the circle at Point B.

The two tangents meet at Point F, as shown in the figure.

- Find the coordinates of Point F.
- Find the area of Triangle FMB.

3. The equations of Lines I and II in the figure are shown below:

$$y = 2x + 10, y = 2x + 30.$$

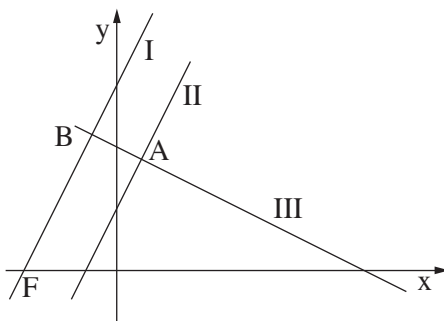
- א. Which equation is that of Line I and which equation is that of Line II?

Explain.

- ב. Line III is perpendicular to Line II and intersects it at Point A, at which $x = 4$.

Find the equation of Line III.

- ג. (1) Show that Line III is perpendicular to Line I.
 (2) Line III intersects Line I at Point B. Line I intersects the x-axis at Point F (see figure). Find the area of Triangle FBA.



Differential and Integral Calculus

4. Given: the function $f(x) = x^3 + 1$.

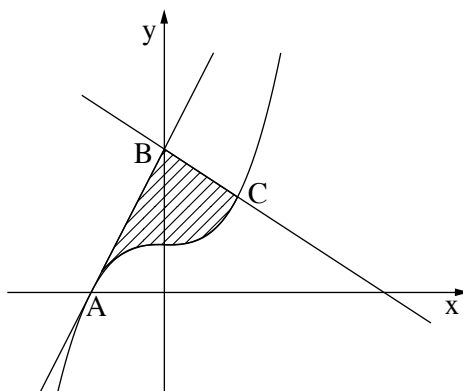
- א. Point C is located on the graph of the function $f(x)$ in the first quadrant [רביע].

The slope of the line that is tangent to the graph of the function $f(x)$ at Point C is 3.

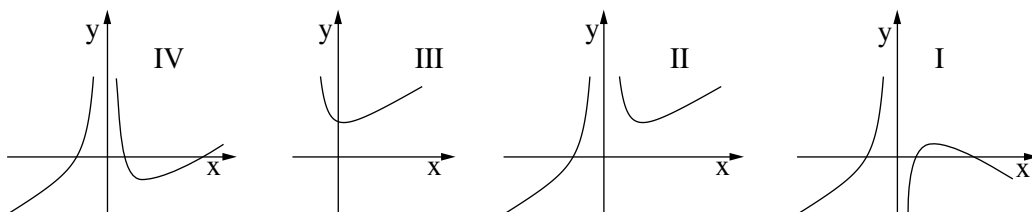
Find the coordinates of Point C.

The graph of the function intersects the x-axis at Point A. The line $y = 3x + 3$ passes through Point A and intersects the y-axis at Point B, as shown in the figure.

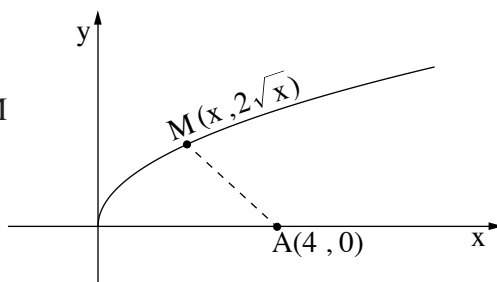
- ב. Find the coordinates of Point B, and find the equation of Line BC.
 ג. Find the area of the region that is bordered by the graph of the function $f(x)$, Line BA (BA is tangent to $f(x)$), and Line BC (the shaded area in the figure).



5. Given: the function $f(x) = x + \frac{4}{x^2}$.
- Find the domain [תחום ההגדרה] of the function.
 - Find the vertical asymptote of the function.
 - Find the coordinates of the extremum [נקודת הקיצון] of the function and determine what type of extremum it is.
 - Find the intervals over which the function is increasing and decreasing.
 - Which of the graphs below, I , II , III or IV, describes the given function? Explain.



6. Given: the function $f(x) = 2\sqrt{x}$
 (see figure).
- Find the x -coordinate of Point M on the graph of the function, whose distance squared (d^2) from Point A(4, 0) is smallest.
 - Find the minimum distance (d) between Point M and Point A.



Good Luck!

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בהצלחה!

זכות היוצרים שמורה למדינת ישראל
 אין להעתיק או לפרסם אלא ברשות משרד החינוך