

Mathematics

3 Points — 3rd Exam

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, Differential and Integral Calculus.

You must answer four questions — $4 \times 25 = 100$ 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 programming options may lead to the disqualification of your exam.

(2) Formula sheets (attached)

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

ד. Special instructions:

- (1) Do not copy the question, but do 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 lead to disqualification of your exam.
- (3) For draft paper, use the answer booklet.
Use of other draft paper may lead to the disqualification of your exam.

Good Luck!

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 — $4 \times 25 = 100$ 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.
שימוש בטייטה אחרת עלול לגרום לפסילת הבחינה.

בהצלחה!

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 your 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

1. A jewelry store sells rings and watches.

All the rings are the same price, which is 60% higher than the price of the watches (all the watches are also the same price).

The price of 4 rings is 4,032 shekels.

א. What is the price of one watch?

ב. The store sold 22 items (rings and watches) in a transaction worth a total of 17,262 shekels.

In this transaction, how many rings were sold, and how many watches were sold?

2. ABC is a right triangle ($\angle BAC = 90^\circ$).

Side BC is parallel to the x-axis

(see figure).

Given: The equation of the line BA

$$\text{is } y = \frac{1}{3}x, A(12,4).$$

א. Find the equation of the line AC.

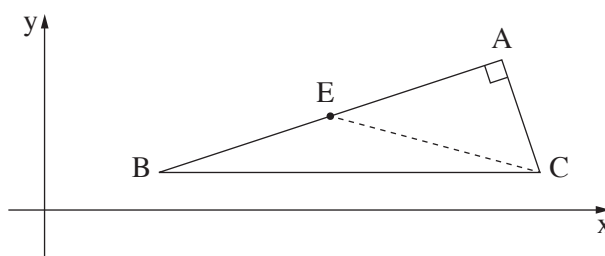
The x-coordinate of Vertex B is 3.

ב. (1) Find the y-coordinate of Vertex B.

(2) Find the coordinates of Vertex C.

Point E is the midpoint of Segment BA.

ג. Calculate the area of Triangle EAC.



3. The figure to the right shows the circle

$$(x - 4)^2 + (y - 7)^2 = R^2 \text{ whose center is Point M.}$$

The point A (6, 3) is located on the circle (see figure).

O is the origin.

א. (1) Calculate the radius of the circle. You may leave a root sign in your answer.

(2) Write out the equation of the circle.

The circle intersects the y-axis at Points C and D, as shown in the figure.

ב. Find the coordinates of Points C and D.

A tangent to the circle was drawn through Point A.

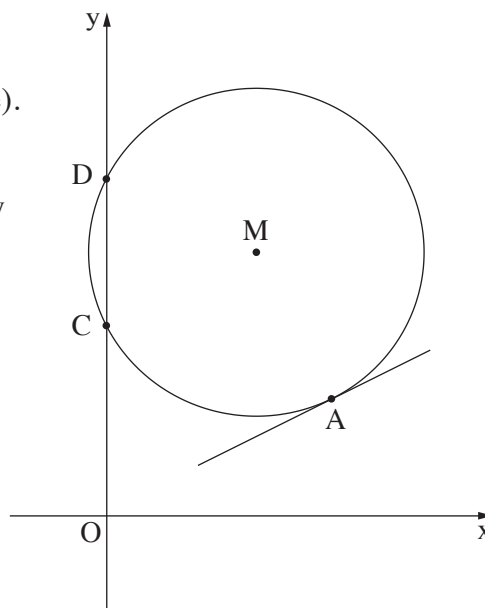
ג. (1) Find the slope of the tangent.

(2) Find the equation of the tangent.

(3) Does the tangent pass through the origin? Explain.

ד. Calculate the perimeter of Quadrilateral AMCO.

Your answer should be correct to two decimal places.



Differential and Integral Calculus

4. Given: The function $f(x) = 3\sqrt{x}$.

א. What is the domain [תחום ההגדרה] of function $f(x)$?

ב. A tangent to the graph of function $f(x)$ was drawn through the point where $x = 4$.

(1) Find the slope of the tangent.

(2) Find the equation of the tangent.

ג. (1) Show that function $f(x)$ has no internal extrema [נקודות קיצון פנימיות].

(2) Find the intervals on which function $f(x)$ increases and decreases (if there are any such intervals).

5. The figure to the right shows the graph of the function
 $f(x) = 2x^3 - 9x^2 + 12x - 6$.

A line was drawn parallel to the x-axis, through the point at which the graph of function $f(x)$ intersects the y-axis.

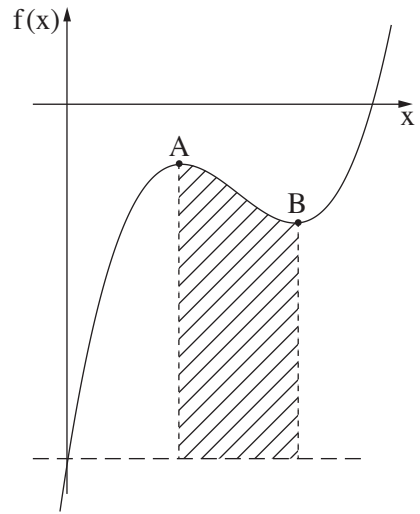
- א. Find the equation of the parallel line.

A and B are the extrema [נקודות קיצון] of function $f(x)$, as shown in the figure.

- ב. Find the coordinates of Points A and B.

Perpendiculars to the parallel line were drawn through Points A and B (see figure).

- ג. Calculate the area of the shaded region in the figure: the region bounded by the graph of function $f(x)$, the perpendiculars that were drawn, and the line parallel to the x-axis.



6. ABCD is a rectangle with an area of 25.

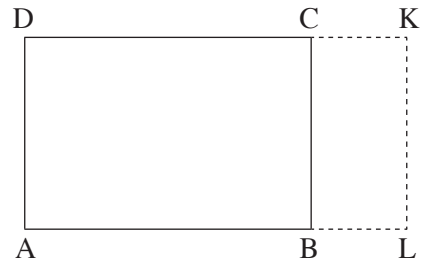
Let x denote the length of Side AB.

- א. Express the length of Side AD in terms of x .

Each of the sides AB and DC were extended by 2, forming a new rectangle, ALKD, as shown in the figure.

- ב. (1) Express the perimeter of Rectangle ALKD in terms of x .

- (2) Find the length of Side AB for which the perimeter of Rectangle ALKD is minimal (smallest).



Good Luck!

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בהצלחה!

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