

Mathematics

3 Points – 3rd Exam

מתמטיקה

3 יחידות לימוד – שאלון שלישי

Instructions

א. Duration of the exam: Two hours.

הוראות

א. משך הבחינה: שעותיים.

ב. Exam structure and breakdown of points:

This exam has six questions on the topics – Algebra, Calculus.

Answer four questions – each question is worth 27 points. In total – a maximum of 100 points.

ב. מבנה השאלון ומפתח ההערכה:

בשאלון זה שש שאלות בנושאים –

אלגברה, חשבון דיפרנציאלי ואינטגרלי.

יש לענות על ארבע שאלות – לכל שאלה 27 נקודות.

סך הכול – 100 נקודות לכל היותר.

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.

ג. חומר עזר מותר בשימוש:

(1) מחשבון לא גרפי. אין להשתמש באפשרויות התכנות

במחשבון שיש בו אפשרות תכנות.

שימוש במחשבון גרפי או באפשרויות התכנות במחשבון

עלול לגרום לפסילת הבחינה.

(2) דפי נוסחאות (מצורפים).

(3) מילון עברי–לועזי/לועזי–עברי.

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 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.

ד. הוראות מיוחדות:

(1) אין להעתיק את השאלה; יש לסמן את מספרה בלבד.

(2) יש להתחיל כל שאלה בעמוד חדש. יש לרשום במחברת

את שלבי הפתרון, גם כאשר החישובים מתבצעים בעזרת מחשבון.

יש להסביר את כל הפעולות, כולל חישובים, בפירוט ובצורה ברורה ומסודרת.

חוסר פירוט עלול לגרום לפגיעה בציון או לפסילת הבחינה.

Write in the answer booklet only. Write "טיטה" at the top of every page you use for draft work.

If you use pages outside the answer booklet for draft work, your exam may be disqualified.

יש לכתוב במחברת הבחינה בלבד. יש לרשום "טיטה" בראש כל עמוד

המשמש טיטה.

כתיבת טיטה בדפים שאינם במחברת הבחינה עלולה לגרום לפסילת הבחינה.

Good Luck!

בהצלחה!

Questions

Answer four of the questions 1–6 (each question – 27 points).

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

Algebra

1. A sports store sells swimsuits and swimming goggles.

The price of a single swimsuit is 2 times the price of a single pair of goggles.

The total price of 5 swimsuits and 12 pairs of goggles is 1,562 shekels.

- א. Find the price of a single pair of goggles.

On a certain day, the number of swimsuits sold in the store was greater by 9 than the number of pairs of goggles sold.

The store's total sales from swimsuits and pairs of goggles that day was 5,112 shekels.

- ב. Find the number of pairs of goggles sold on that day.

In preparation for the summer vacation, the store advertised two special offers:

Offer A – discount of 25 shekels on the total purchase.

Offer B – discount of 15% on the total purchase.

Customers could choose one of the two offers.

Sha'ked came to the store to buy one swimsuit and one pair of goggles.

- ג. Determine which offer is cheapest for Sha'ked. Explain your answer.

2. ABCD is a right trapezoid ($\angle ABC = 90^\circ$, $AD \parallel BC$).

Point E is the midpoint of Side AB (see figure).

We know $A(0, 6)$, $E(3, 0)$.

- א. Find the coordinates of Vertex B.

- ב. (1) Find the slope of Side AB.
(2) Find the equation of Side BC.

Vertex C is located on the x-axis.

- ג. Find the coordinates of Vertex C.

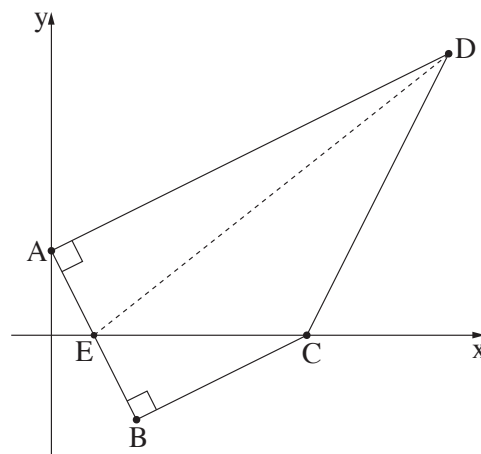
Below are four equations, I–IV.

I. $y = 0.5x + 3$ II. $y = 0.5x + 6$ III. $y = 2x - 36$ IV. $y = 2x - 30$

One of the equations matches Line AD, and one of the equations matches Line CD.

- ד. Determine which equation matches Line AD, and which equation matches Line CD.
Explain your answers.

- ה. (1) Find the coordinates of Vertex D.
(2) Find the area of Triangle ECD.



3. Consider a circle whose center is at Point A .

Point B is the intersection point of the circle with the negative part of the x-axis.

We know the equation of the circle is $(x + 2)^2 + (y - 6)^2 = 45$.

א. (1) What are the coordinates of Point A , the center of the circle?

(2) Find the coordinates of Point B .

ב. Find the slope of AB .

A tangent to the circle was drawn through Point B .

ג. Find the equation of the tangent.

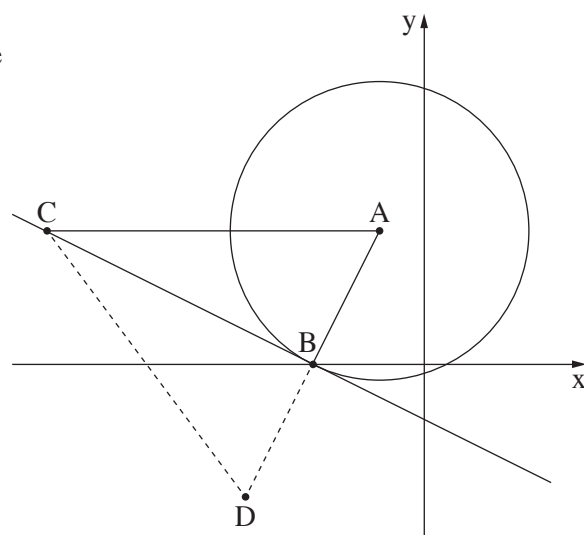
Point C is located on the tangent such that AC is parallel to the x-axis.

ד. Find the coordinates of Point C .

Point D is located on the extension of Segment AB .

We know that Point B is the midpoint of Segment AD .

ה. Is Triangle ACD an isosceles triangle [משולש שווה שוקיים]? Explain your answer.



Calculus

4. The figure on the right describes the graph of function $f(x) = 4x + \frac{9}{x} - 3$.

א. (1) Find the domain [תחום ההגדרה] of function $f(x)$.

(2) Find the equation of the asymptote of function $f(x)$ that is perpendicular to the x-axis.

ב. Find the coordinates of the extrema [נקודות הקיצון] of function $f(x)$, and determine what type of extrema they are.

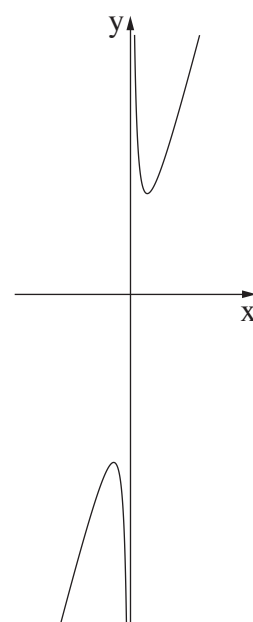
ג. Find the intervals on which function $f(x)$ is increasing.

ד. Below are two statements, I–II .

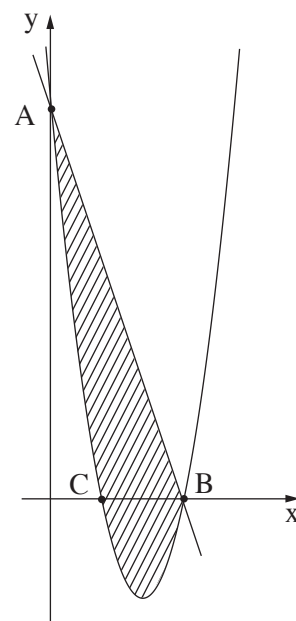
For each statement, determine whether it is true or false, and explain your answers.

I The line $y = -15$ intersects the graph of function $f(x)$ at two points.

II The slope of the tangent to the graph of function $f(x)$ at the point where $x = 1.5$ is 0 .



5. The figure on the right describes the graph of function $f(x) = 2x^2 - 11x + 12$. Point A is the intersection point of the graph of function $f(x)$ with the y-axis. Points B and C are the intersection points of the graph of function $f(x)$ with the x-axis, as shown in the figure.



- א. Find the coordinates of Points A, B, and C.

A line is drawn through Points A and B.

- ב. Below are two equations, I–II.

I $y = -2x + 12$

II $y = -3x + 12$

Determine which of them is the equation of Line AB, and explain your answer.

- ג. Calculate the shaded area in the figure:
the area bounded by the graph of function $f(x)$ and Line AB.

6. The figure on the right describes the graph of function $f(x) = -\frac{1}{3}x^3 + 9$.

- א. Show that the graph of function $f(x)$ intersects the x-axis at Point (3, 0).

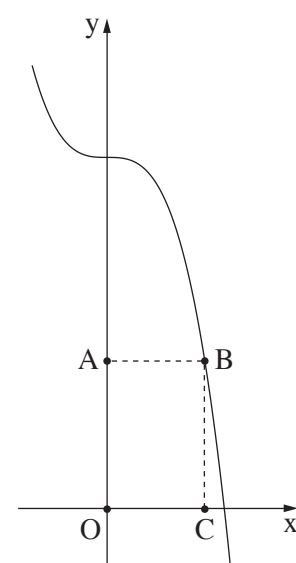
Point B is located on the graph of function $f(x)$ in the first quadrant.

Two perpendiculars are dropped from Point B, one to the y-axis intersecting it at Point A, and one to the x-axis intersecting it at Point C.

Point O is the origin.

Let x denote the x-coordinate of Point B.

- ב. (1) Express the y-coordinate of Point B in terms of x .
(2) Express the perimeter of Rectangle ABCO in terms of x .
- ג. (1) Find the value of x for which the perimeter of Rectangle ABCO is a maximum.
(2) Using the value of x that you found, calculate the perimeter of Rectangle ABCO.



Good Luck!

All rights reserved by the State of Israel.
Copying or publication without the consent of the
Ministry of Education is prohibited.

בהצלחה!

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