

Note: This exam has special instructions.
Answer the questions according to these instructions.

שימו לב: בבחינה זו יש הנחיות מיוחדות.
יש לענות על השאלות על פי הנחיות אלה.

Mathematics

3 Points – 3rd Exam

מתמטיקה

3 יחידות לימוד – שאלון שלישי

Instructions

א. Duration of the exam: Two and a quarter hours.

הוראות
א. משך הבחינה: שעה ורבע.

ב. Exam structure and breakdown of points:

This exam has six questions on the following topics:
Algebra, Differential and Integral Calculus.

Answer four questions – each question is worth
27 points.

The maximum points you can earn in total – 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 paper,
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. In a particular clothes store the price of a coat is 76 shekels more than the price of a shirt.

The store announced a sale giving a 15 % discount on the price of a shirt (the price of a coat remained unchanged).

The total price of one shirt on sale and one coat is 172.2 shekels.

- א. (1) Find the price of a shirt before the discount.
(2) Find the price of a shirt on sale.

In preparation for the eleventh grade class trip, Rotem bought 80 items in the store: some were coats, and the rest were shirts on sale.

She paid a total of 4,960.6 shekels.

- ב. Find the number of shirts that Rotem bought.

Nadav bought 4 coats in the store.

When Nadav reached the cashier in order to pay, he discovered that he was eligible for a discount on the price of the coats since he was a member of the store's customer club.

Nadav paid a total of 480 shekels.

- ג. Find the discount percentage that Nadav received on the price of the coats.

2. In the right triangle ABC ($\angle ACB = 90^\circ$), Vertex B is located on the y -axis, and Side AB intersects the x -axis at Point D .

We know that the equation of Side AB is $y = -\frac{1}{2}x + 4$.

- א. Find the coordinates of Points B and D .

Point D is the midpoint of Side AB .

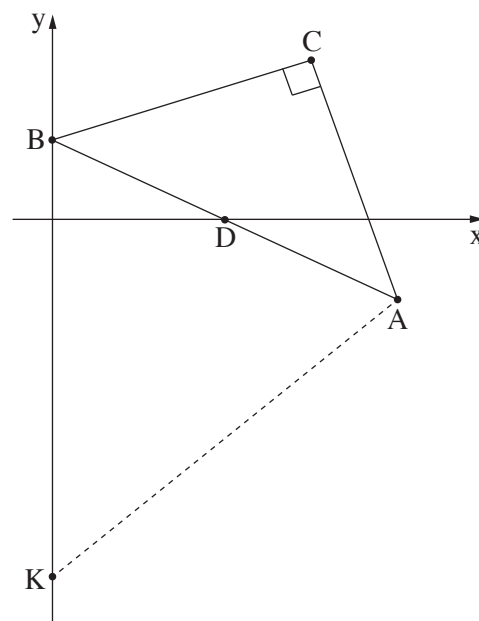
- ב. Find the coordinates of Vertex A .

We know that the equation of Side BC is $y = \frac{1}{3}x + 4$.

- ג. (1) Find the equation of Side AC .
(2) Find the coordinates of Vertex C .

We know that: $K(0, -18)$.

- ד. (1) Calculate the area of Triangle ABC .
(2) Calculate the area of Quadrilateral $BCAK$.



3. Consider a circle whose center is M and whose equation is $(x - 12)^2 + (y - 10)^2 = 117$.

Points B and C are located on the circle, such that BC is a diameter in the circle, as shown in the figure.

We know that the x -coordinate of Point C is 21.

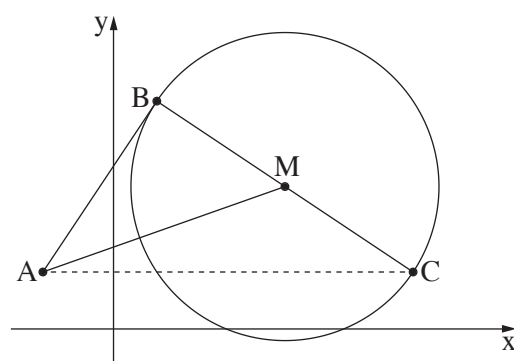
- א. What are the coordinates of Point M ?
ב. (1) Find the coordinates of Point C
(the y -coordinate of Point C is less than 10).
(2) Find the coordinates of Point B .

Line AB is tangent to the circle at Point B .

- ג. (1) Find the slope of Line BM .
(2) Find the equation of Line AB .

We know that Line AC is parallel to the x -axis.

- ד. Find the coordinates of Point A .
ה. Find the perimeter of Triangle AMC .



Differential and Integral Calculus

4. The figure to the right shows the graph of function $f(x) = \frac{18}{x} + 2x - 15$.

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

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

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

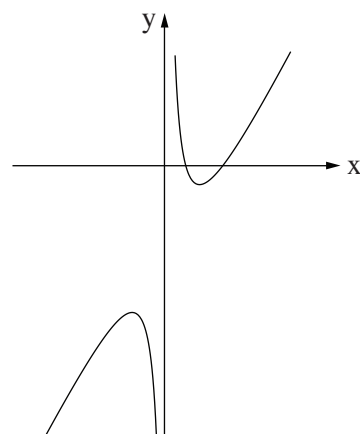
ד. Below are two statements, I–II.

Determine whether each statement is true or false.

Explain your answers.

I The graph of function $f(x)$ intersects the x -axis at the point where $x = 1.5$.

II Function $f(x)$ is positive at the point where $x = 2$.



5. Consider the function $f(x) = x^3 - 9x^2 + 15x + 27$.

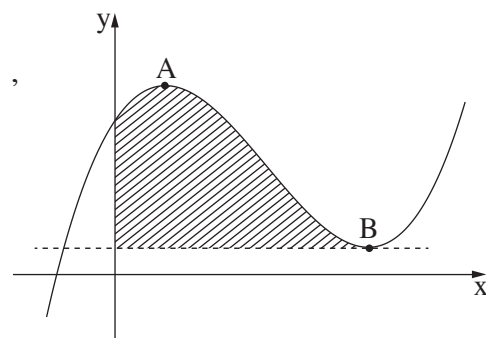
Points A and B are the extrema [נקודות הקיצון] of function $f(x)$, as shown in the figure.

א. Find the coordinates of Points A and B.

ב. Find the equation of the tangent to the graph of function $f(x)$ at its minimum.

ג. Calculate the area of the shaded region in the figure:

the region bounded by the graph of function $f(x)$, the tangent, and the y -axis.



6. In Rectangle ABCD, the length of Side BC is 2 times greater than the length of Side DC.

A square, DEFG, is constructed on top of the rectangle, such that Vertex G is located on Side AD (see figure).

We know that $CE = 21$.

Let x denote the length of Side DC.

א. (1) Express the length of Side BC and the length of Side DE in terms of x .

(2) Express the area of Square DEFG in terms of x .

ב. Find the value of x for which the sum of the areas of the square and the rectangle is minimum (smallest).

ג. Find the sum of the areas of the square and the rectangle for the value of x that you found in Item ב.

