

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.

Each question is worth 30 points.

You may answer as many questions as you like but the maximum number of points you can earn is 100,

ג. Material that may be used during the exam:

- (1) A non-graphing calculator. Do 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.

Write in your answer booklet only. Write "טיטה" at the top of each draft page. If you write draft work outside your answer booklet, your exam may be disqualified.

Good Luck!

מתמטיקה

3 יחידות לימוד — שאלון שלישי

הוראות לנבחן

א. משך הבחינה: שעותיים.

ב. מבנה השאלון ומפתח ההערכה:

בשאלון זה שש שאלות. לכל שאלה 30 נקודות.

מוותר לך לענות על מספר שאלות כרצונך, אך סך הנקודות שתוכל לצבור לא יעלה על 100.

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.

כתוב במחברת הבחינה בלבד. רשום "טיטה" בראש כל עמוד המשמש טיטה. כתיבת טיטה בדפים שאינם במחברת הבחינה עלולה לגרום לפסילת הבחינה.

בהצלחה!

Questions

This exam has six questions. A complete answer is worth 30 points.

You may answer as many questions as you like, completely or partially, but the maximum number of points that you can earn is 100.

Note: Explain all of your work, including calculations, clearly and in detail.

Lack of detail may lower your score or lead to disqualification of your exam.

Algebra

1. A merchant bought x white shirts, each for the same price, and he paid a total of 840 shekels.
 - א. Express the price that the merchant paid for each white shirt in terms of x .

The merchant also bought 40 black shirts. He paid the same price for a black shirt as he paid for a white shirt.

The merchant sold each white shirt at a 30% profit and each black shirt at a 25% profit.

The merchant sold the shirts for a total of 2,842 shekels.

- ב. (1) Find the number of white shirts that the merchant bought.
 - (2) Find the price that the merchant paid for each shirt.
- ג. What was the merchant's profit percentage on the sale of all the shirts (black and white shirts)?

2. In Triangle ABO, Vertex A is located on the x-axis. Point O is the origin (see figure).

The equation of Line AB is $y = \frac{1}{2}x + 5$.

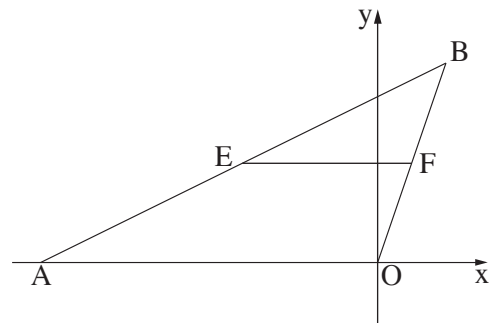
- א. Find the coordinates of Point A.

Point E(-4, 3) is the midpoint of Segment AB.

- ב. Find the coordinates of Point B.
- ג. Find the equation of Line OB.

Point F is located on Line OB such that EF is parallel to the x-axis.

- ד. Find the length of Segment EF.
- ה. Calculate the area of Triangle BEF.



3. Given: a circle whose center is M and whose equation is $(x + 3)^2 + y^2 = 25$.

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

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

A tangent to the circle was drawn at Point A .

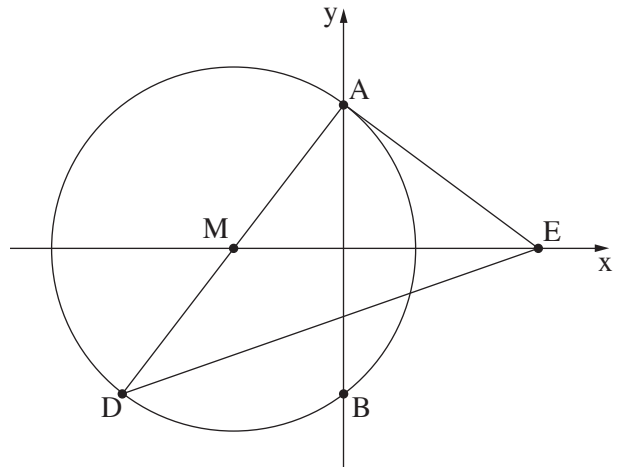
- ב. (1) Find the slope of Line MA .
(2) Find the equation of the tangent.

The tangent intersects the x -axis at Point E .

- ג. (1) Find the coordinates of Point E .
(2) Find the length of Segment AE .

Point D is located on the circle such that AD is a diameter of the circle.

- ד. Calculate the area of Triangle DAE .



Differential and Integral Calculus

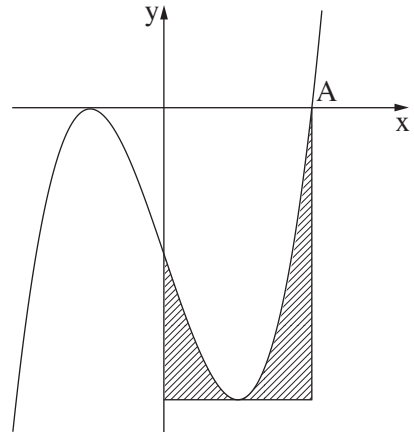
4. Given: the function $f(x) = \frac{12}{x} + 3x + 2$.

- א. What is the domain [תחום ההגדרה] of the function $f(x)$?
- ב. Find the coordinates of the extrema [נקודות הקיצון] of the function $f(x)$, and determine what type of extrema they are.
- ג. Find the intervals on which the function $f(x)$ is increasing and the intervals on which the function is decreasing.
- ד. A tangent to the graph of the function $f(x)$ was drawn at a point in the first quadrant. The slope of this tangent is (-9) .
- (1) Find the coordinates of the point of tangency of the tangent.
- (2) Find the equation of the tangent.

5. The figure to the right describes the graph of the function

$$f(x) = x^3 - 3x - 2.$$

- א. Find the coordinates of the extrema [נקודות הקיצון] of the function $f(x)$, and use the graph to determine what type of extrema they are.
- ב. Find the equation of the tangent to the graph of the function $f(x)$ at the function's minimum.



Point $A(2, 0)$ is an intersection point of the graph of the function $f(x)$ with the x -axis, as shown in the figure.

- ג. Find the area of the shaded region in the figure - the region bounded by:
 - the graph of the function $f(x)$,
 - the tangent that you found in Item ב,
 - the perpendicular dropped from Point A to the tangent,
 - and the y -axis.

6. The figure to the right shows the graphs of functions

$$g(x) = x^2 - 12, \quad f(x) = -4x^3 + 10x^2 + 14.$$

Point A is located on the graph of function $f(x)$ and

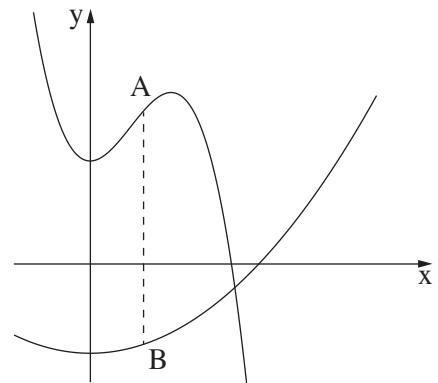
Point B is located on the graph of function $g(x)$.

Segment AB is parallel to the y -axis.

The x -coordinate of Point A and Point B is positive.

Point A is located above Point B , as shown in the figure.

Let x be the x -coordinate of Points A and B .



- א. Express the length of Segment AB in terms of x .
- ב. Find the value of x for which the length of Segment AB is maximal.
- ג. For the value of x you found in Item ב, find the distance of Point B from the x -axis.

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