

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. 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 the disqualification of your exam.

Write in the answer booklet only.

Write "טיוטה" at the top of every page you use for draft.

If you write draft material outside the answer booklet, your exam may be disqualified.

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.
מותר 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 שיש בו אפשרות 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 "טיוטה" בראש כל עמוד המשמש טיוטה.
כתיבת טיוטה בדפים שאינם במחברת הבחינה עלולה לגרום לפסילת הבחינה.

Good Luck!

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 the disqualification of your exam.

Algebra

1. A community center organizes junior and adult art classes.

The community center orders a set of 5 sheets of paper and 2 boxes of paints for each art class participant.

The price of a set for a participant in the junior class is 180 shekels.

The price of a sheet of paper ordered for the adult class is 40% higher than the price of a sheet of paper for the junior class.

The price of a box of paints ordered for the adult class is 60% higher than the price of a box of paints for the junior class.

The price of a set for the adult class is 273 shekels.

א. Find the price of a sheet of paper and the price of a box of paints ordered for the junior class.

ב. The community center charges each art class participant (junior and adult) 1,500 shekels.

There are 58 students in total in the junior group. There are 62 students in total in the adult group.

In which class (junior or adult) does the community center have more money left over after ordering the sets?

Show detailed calculations.

2. The figure to the right shows Quadrilateral ABOC (Point O is the origin).

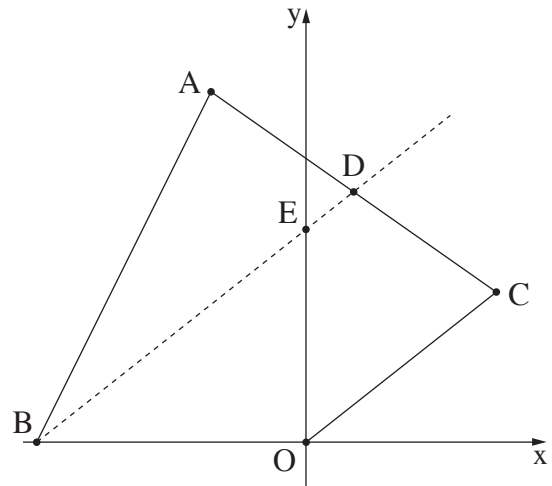
Given: $A(-6, 21)$;

Point $D(3, 15)$ is the midpoint of Side AC.

- א. Find the coordinates of Point C.

Given: Line BD is parallel to Line OC.

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



The line whose equation you found in Item ב

intersects the y-axis at Point E, and the x-axis at Point B.

- ג. Find the coordinates of Points E and B.
ד. (1) Find the perimeter of Triangle BEO.
(2) Find the area of Triangle BEO.
ה. Find the area of Quadrilateral BECO.

3. The figure to the right shows a circle whose center is Point $M(3, 2)$.

Points A and C are the intersection points of the circle and the y-axis.

Given: $A(0, 8)$, $C(0, -4)$.

- א. Find the equation of the circle.

Point B is located on the circle such that BC is parallel to the x-axis.

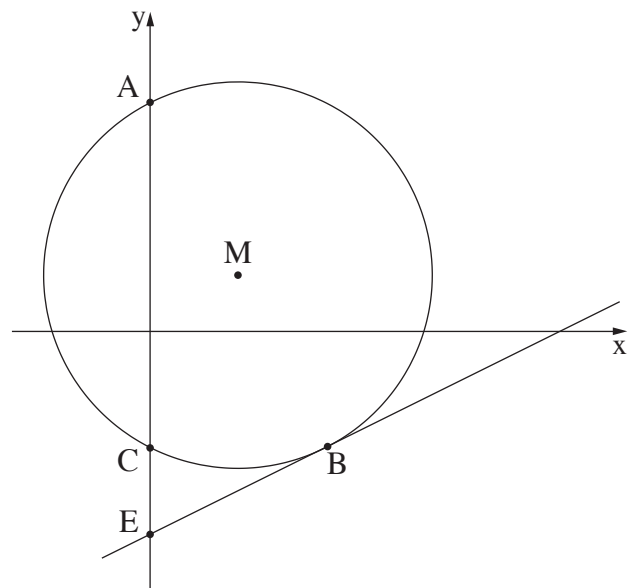
- ב. Find the coordinates of Point B.
ג. Prove that AB is a diameter of the circle.

A tangent to the circle was drawn through Point B.

- ד. Find the equation of the tangent.

The tangent whose equation you found in Item ד intersects the y-axis at Point E.

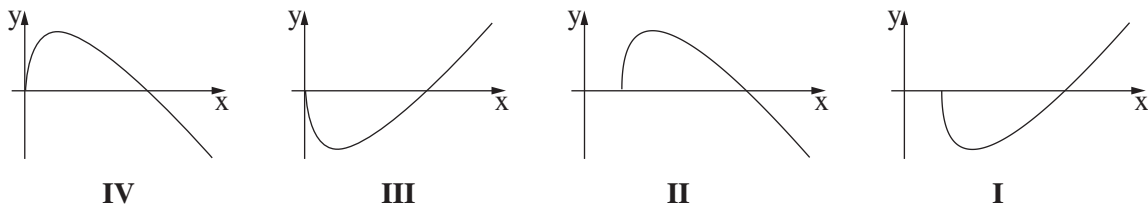
- ה. Find the area of Triangle BCE.



Differential and Integral Calculus

4. Given: the function $f(x) = 2x - 10\sqrt{x}$.

- א. Find the domain [תחום ההגדרה] of the function $f(x)$.
- ב. A list of points which are located on the x-axis is given below. Determine which ones are located on the graph of function $f(x)$. Explain.
 $(9, 0)$, $(25, 0)$, $(16, 0)$, $(0, 0)$
- ג. Find the coordinates of the internal extremum [נקודת קיצון] of the function $f(x)$, and determine what type of extremum it is.
- ד. Find the interval on which the function $f(x)$ is increasing and the interval on which it is decreasing.
- ה. One of the graphs I - IV below describes the graph of function $f(x)$. Determine which graph it is, and explain your answer.



5. The graphs I and II shown in the figure below describe the following functions:

$$f(x) = -x^2 + 16x - 48, \quad g(x) = x^2 - 14x + 52.$$

- א. Which graph, I or II, describes the graph of function $f(x)$, and which graph describes the graph of function $g(x)$? Explain.

Graph II intersects the x-axis at Points C and D, as shown in the figure.

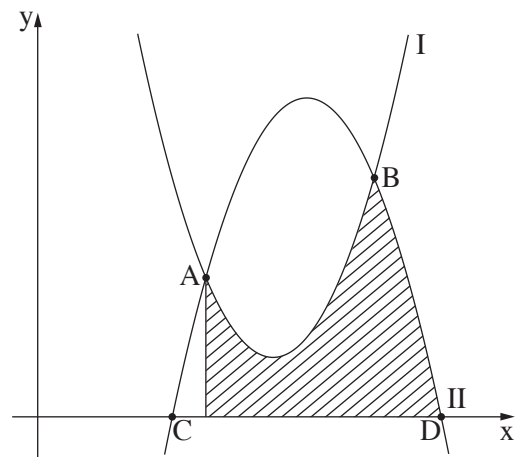
- ב. Find the coordinates of Points C and D.

The graphs of the functions intersect at Points A and B, as shown in the figure.

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

A perpendicular was dropped from Point A to the x-axis.

- ד. Find the area of the shaded region in the figure:
the region bounded by the perpendicular, the graph of function $g(x)$, the graph of function $f(x)$, and the x-axis.



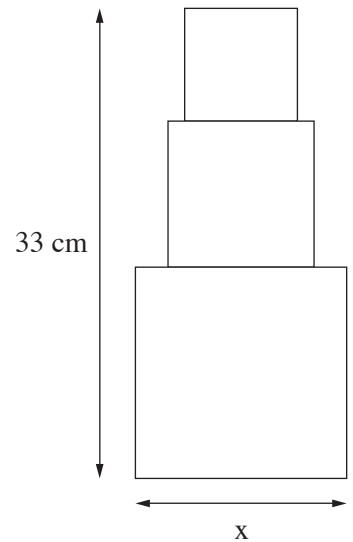
6. The figure to the right is composed of three adjacent squares.

The total height of the three adjacent squares is 33 cm.

The side length of the top square in the figure is 5 cm smaller than the side length of the bottom square.

Let x denote the side length of the bottom square.

- א. Express the side length of the top square and the side length of the middle square in terms of x .
- ב. Find the value of x for which the sum of the areas of the three squares is minimal.
- ג. Find the minimum sum of the areas of the three squares.



Good Luck!

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בהצלחה!

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