

Mathematics

Questionnaire א

Instructions for examinees

א. Duration of the exam: One hour and 45 minutes.

ב. Exam structure and breakdown of points:

This exam has five questions in the topic areas:

Algebra and Differential and Integral Calculus.

You must answer three questions –

$$3 \times 33\frac{1}{3} = 100 \text{ points}$$

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 the programming options may lead to the disqualification of the exam.

(2) Formula sheets (attached).

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

ד. Special instructions:

- (1) Do not copy the question; only 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 disqualify the exam.
- (3) For draft paper, use the answer booklet or paper you receive from the proctors. Use of other draft paper may lead to the disqualification of the exam.

Good Luck!

/Continued on the next page/

מתמטיקה

שאלון א

הוראות לנבחן

א. משך הבחינה: שעה ושלושה רבעים.

ב. מבנה השאלון ומפתח ההערכה:

בשאלון זה חמש שאלות בנושאים:

אלגברה, חשבון דיפרנציאלי ואינטגרלי.

עליך לענות על שלוש שאלות –

$$3 \times 33\frac{1}{3} = 100 \text{ נקודות}$$

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) לטיוטה יש להשתמש במחברת הבחינה או בדפים שקיבלת מהמשיגים. שימוש בטיוטה אחרת עלול לגרום לפסילת הבחינה.

בהצלחה!

/המשך מעבר לדף/

Questions

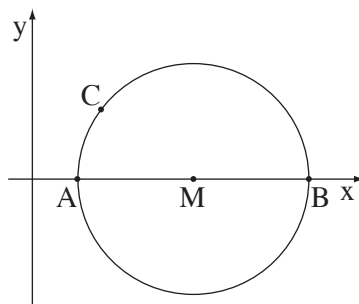
Note! Explain all of your work, including calculations, clearly and in detail.
Lack of detail may lower your score or lead to the disqualification of the exam.

Answer three of the questions 1-5 (each question – $33\frac{1}{3}$ points).

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

Algebra

1. Two trains began traveling toward each other at the same time. Each train traveled at a constant speed. Train I left from Station A and Train II left from Station B. The distance between Stations A and B is 900 km. The speed of Train I was V km/h and the speed of Train II was 2 times greater than the speed of Train I.
 - א. Find V , if we know that, after 3 hours, the distance between the trains was 90 km.
 - ב. After Train I arrived at Station B, it began its trip back to Station A traveling at a constant speed. The amount of time that it took Train A to return to Station A is 20% greater than the amount of time it needed to reach Station B. What was the speed of Train I on its way back to Station A? Show detailed calculations.
2. The sketch on your right shows a circle whose equation is $(x - 7)^2 + y^2 = R^2$. (M – the center of the circle).
 Points A and B are the points at which the circle intersects the x-axis. Point C is located on the circle within the first quadrant.
 Given: the length of Segment AB is 10.
 - א. Find R .
 - ב. Find the coordinates of Points A and B.
 - ג. Given: the line $y = \frac{4}{3}x - 1$ is tangent to the circle at Point C.
 - (1) Find the coordinates of Point C.
 - (2) A line that is parallel to the y-axis and intersects the circle at Point D was drawn through Point C. Find the area of Triangle CDB.



Differential and Integral Calculus

3. The function $y = \frac{36}{x} + kx + 1$ is given. (k is a parameter.)

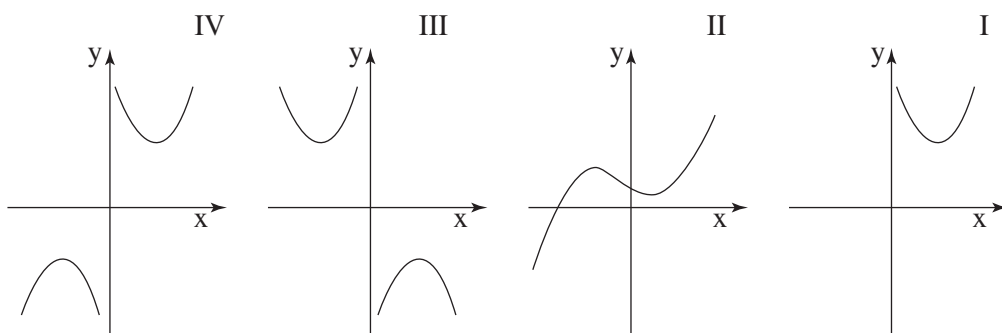
The slope of the tangent to the graph of the function at the point at which $x = 3$ is 5.

א. Find k .

Insert the value $k = 9$ into the function and answer Items ב-ה.

- ב. Find the domain [תחום ההגדרה] of the function.
 ג. Find the extrema [נקודות הקיצון] of the function, and determine what type of extrema they are.
 ד. Find the increasing and decreasing intervals of the function.
 ה. Below are four graphs: I, II, III and IV.

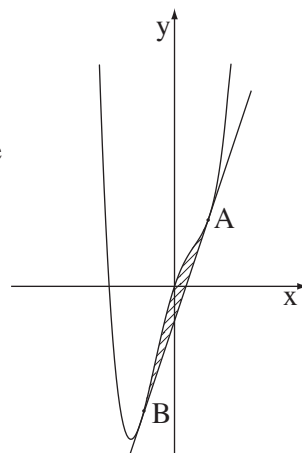
Which of these graphs depicts the given function? Explain.



4. The sketch on the right shows a graph of the function $f(x) = x^4 - 2x^2 + 3x$.

Given: a line with a slope of 3 that is a tangent to the graph of the function at Points A and B (see figure).

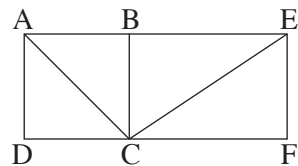
- א. Find the coordinates of Points A and B.
 ב. Find the equation of Line AB.
 ג. Calculate the area of the region bordered by the graph of the function and the tangent (the shaded area in the figure).



5. Segment BC is a side of both Square ABCD and Rectangle BEFC (see figure).

Given: the length of Segment AE is 10 cm.

- א. Find the length of Segment BC for which the sum $AC^2 + CE^2$ is smallest.
- ב. Find the smallest value of the sum $AC^2 + CE^2$.



Good Luck!

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בהצלחה!

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

Note!

**Question 6 is only for students who have been
given permission to take the adapted exam.**

(Purple sticker)

You must answer three of the questions 1-6.

6. The derivative of the function $f(x)$ is $f'(x) = 3x^2 - 2x + 3$.

Given: the function passes through the point $(-1, 1)$.

- א. Find $f(x)$.
- ב. Show that the function increases for every x .
- ג. Find the equation of the line that is tangent to the graph of the function at the point at which $x = 1$.