

Mathematics

3 Points — Third Questionnaire

Instructions for examinees

- א. Duration of the exam: Two hours
- ב. Exam structure and breakdown of points:
This exam has six questions in the topic areas:
Algebra and Differential and Integral Calculus.
You must answer four questions –
 $4 \times 25 = 100$ 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 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.
 - (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 your exam.

Good Luck!

מתמטיקה

3 יחידות לימוד — שאלון שלישי

הוראות לנבחן

- א. משך הבחינה: שתיים.
- ב. מבנה השאלון ומפתח ההערכה:
בשאלון זה שש שאלות בנושאים:
אלגברה, חשבון דיפרנציאלי ואינטגרלי.
עליך לענות על ארבע שאלות –
 $100 = 25 \times 4$ 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) לטייטה יש להשתמש במחברת הבחינה או בדפים שקיבלת מהמשיגים.
 - שימוש בטייטה אחרת עלול לגרום לפסילת הבחינה.

בהצלחה!

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 your exam.

Answer four of the questions 1-6 (each question – 25 points).

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

Algebra

1. A bicycle store sells two kinds of bikes: regular bikes and cross-country bikes.

The price of the cross-country bikes is 300 shekels higher than the price of the regular bikes.

As a result of price changes, the cross-country bikes became 12% more expensive, while the regular bikes became 18% cheaper.

The amount that was added to the price of the cross-country bikes (in shekels) is equal to the amount that was deducted from the price of the regular bikes (in shekels).

- א. What was the price of the regular bikes before the reduction in price?
- ב. After the change in the prices, how much more expensive (in shekels) are the cross-country bikes than the regular bikes?

2. In Triangle ABC, Side BC rests on the x-axis, as shown in the figure.

Given: $BC = 10$,

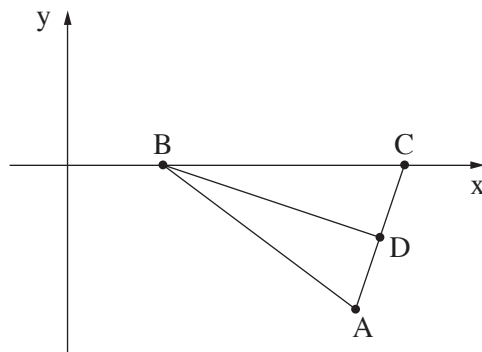
Vertex A is located at the

point $(12, -6)$,

the equation of Side AB is

$$y = -\frac{3}{4}x + 3.$$

- א. (1) Find the coordinates of
Vertex B.
- (2) Find the coordinates of
Vertex C.



BD is a median [תיכון] of Triangle ABC.

- ב. Find the equation of BD.
- ג. Show that BD is perpendicular [מאונך] to AC.
- ד. Find the area of Triangle ABC.
- ה. How many times greater than the area of Triangle BCD is the area of Triangle ABC? Explain.

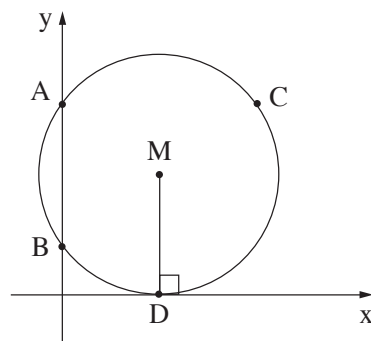
3. Given: a circle whose center is located at Point M $(4,5)$.

D is a point that is common to the circle

and the x-axis, such that MD is

perpendicular [מאונך] to the x-axis (see figure).

- א. (1) Find the length of MD,
the radius of the circle.
- (2) Write the equation of the circle.



Points A and B are the points at which

the circle intersects the y-axis, as shown in the figure.

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

BC is a diameter of the circle.

- ג. Find the coordinates of Point C.
- ד. Find the perimeter of Triangle CMD.

Differential and Integral Calculus

4. Given: The function $f(x) = x - 4 + \frac{16}{x}$.

- 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. What are the intervals on which the function $f(x)$ is increasing and decreasing?
- ד. Sketch the graph of the function $f(x)$.
- ה. Does the graph of the function $f(x)$ have points at which it intersects the x -axis? If so, find these points. If not, explain why not.

5. The figure to the right shows the graph of the function $f(x) = x^2 + 3$.

A tangent was drawn to the graph of the function at Point A, where $x = -1$.

- א. (1) Find the slope of the tangent.
 (2) Find the equation of the tangent.
- ב. Find the coordinates of Point B, the point at which the tangent intersects the x -axis.

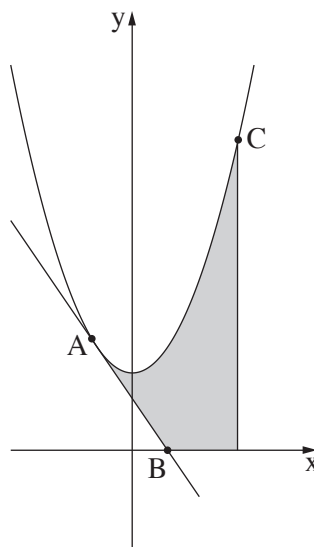
Point C is located on the graph of the function $f(x)$ in the first quadrant.

The y -coordinate of Point C is 12.

- ג. Find the x -coordinate of Point C.

- ד. A perpendicular was drawn from Point C to the x -axis.

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

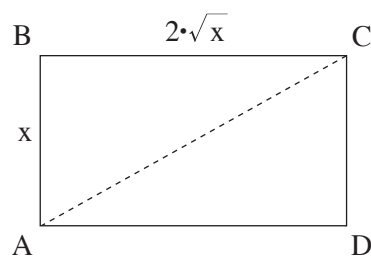


6. The rectangle ABCD is shown on the right.

The length of the side AB is x and
the length of the side BC is $2\sqrt{x}$.

א. For what value of x will the difference
between BC and AB ($BC - AB$) be
greatest [מקסימלי]?

ב. Calculate the length of the diagonal AC
for the value of x that you found
for Item א.



Good Luck!

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בהצלחה!

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