The State of Israel
Ministry of Education
Exam Type: *Bagrut*
Exam Date: Winter 2025
Exam Number: 035472
Appendix: Formula sheets for 4 points
English Translation (3)

מדינת ישראל
משרד החינוך
סוג הבחינה: בגרות
מועד הבחינה: חורף תשפ"ה, 2025
מספר השאלון: 035472
נספח: דפי נוסחאות ל־4 יחידות לימוד
תרגום לאנגלית (3)

תוכנית חדשה

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
4 Points – 2nd Exam

מתמטיקה
4 יחידות לימוד – שאלון שני

Instructions

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

ב. Exam structure and breakdown of points:
This exam consists of two parts, with a total of five questions.
Part One – Sequences, Spatial Geometry, and Growth and Decay
Part Two – Differential and Integral Calculus of Exponential and Logarithmic Functions
Answer three questions, at least one question from each part — $3\times33\frac{1}{3}=100$ points.

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 question 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 only in the answer booklet. Write "טיוטה" at the top of each draft page.
If you use any draft paper outside the answer booklet your exam may be disqualified.

Good Luck!

הוראות

א. משך הבחינה: שעתיים ורבע.

ב. מבנה השאלון ומפתח ההערכה:
בשאלון זה שני פרקים, ובהם חמש שאלות.
פרק ראשון — סדרות, גאומטרייה במרחב וגדילה ודעיכה
פרק שני — חשבון דיפרנציאלי ואינטגרלי של פונקציות מעריכיות ולוגריתמיות
יש לענות על שלוש שאלות, לפחות על שאלה אחת מכל פרק — $3\times33\frac{1}{3}=100$ נקודות.

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. 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.

יש לכתוב במחברת הבחינה בלבד. יש לרשום "טיוטה" בראש כל עמוד המשמש טיוטה.
כתיבת טיוטה בדפים שאינם במחברת הבחינה עלולה לגרום לפסילת הבחינה.

בהצלחה!

Questions

Answer three of the questions 1–5, at least one question from each part (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.

Part One – Sequences, Spatial Geometry, and Growth and Decay

1. Consider a geometric sequence A of 10 terms, whose common ratio is q.
The sixth term in the sequence is 81 times the second term in the sequence.

א. Find the two values of q.

We know that the sum of the two middle terms in Sequence A is 1,944, and that all the sequence's terms are positive.

ב. Find the first term in the sequence.

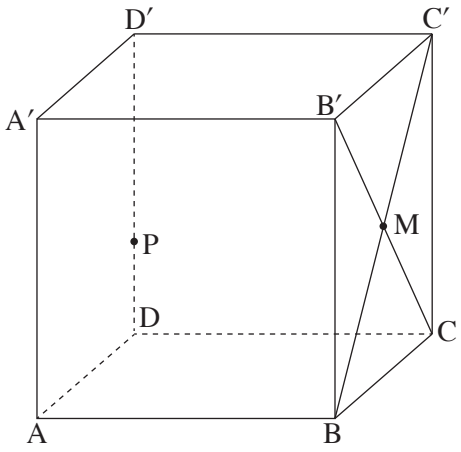
Consider the arithmetic sequence B. The sum of Sequence A is 11 times greater than the sum of Sequence B.

ג. Find the sum of Sequence B.

Sequence B has 33 terms.
We know that the second term in Sequence B is 46 times greater than the sequence's common difference.

ד. Find the common difference of Sequence B.

2. The figure on the right describes a cuboid $ABCDA'B'C'D'$.
Point M is the intersection point of the diagonals on Face $BCC'B'$.
Point P is located on Edge DD' and satisfies $\overrightarrow{DP} = \frac{1}{3}\overrightarrow{DD'}$.
Let $\overrightarrow{AA'} = \underline{w}$, $\overrightarrow{BC} = \underline{v}$, $\overrightarrow{AB} = \underline{u}$.



א. Express the vectors $\overrightarrow{AP}$ and $\overrightarrow{MP}$ in terms of $\underline{u}$, $\underline{v}$, and $\underline{w}$.

We know that $|\underline{w}| = |\underline{u}| = 18$, $|\underline{v}| = 6$.

ב. **(1)** Prove that the vector $\overrightarrow{AP}$ is perpendicular to the vector $\overrightarrow{MP}$.

(2) Calculate the area of Triangle APM.

We know that: D(0, 0, 0);
Vertex A is located on the positive side of the x-axis;
Vertex C is located on the positive side of the y-axis; and
Vertex D′ is located on the positive side of the z-axis.

ג. **(1)** Find the coordinates of Vertices C, B, C′.

(2) Find the coordinates of Point M.

ד. Find the size of Angle PMB.

/Continued on page 3/

3. Amir bought an inflatable swim ring and an inflatable pool float.
On the day he bought them the volume of the ring was 4,900 cubic cm and the volume of the float was 9,800 cubic cm.
The volume of the swim ring and the pool float decreased by a fixed percentage every day as they lost air (each by a different percentage).
7 days after the day of purchase, the volume of the ring was the same as the volume of the float.

א. Determine whether each of the statements I–II , below, is true or false.

I 6 days after the day of purchase, the volume of the ring was greater than the volume of the float.

II 8 days after the day of purchase, the volume of the ring was greater than the volume of the float.

We know that the volume of the ring decreases by 4 % every day.

ב. Find by what percentage the volume of the float decreases every day.

t days after the day of purchase, the volume of the float was $\frac{1}{3}$ of the volume of the ring.

ג. Find the value of t .

Several weeks later, Amir decided to inflate the pool float.
As he inflated it, the float's volume increased by 23 % every minute.
When he finished inflating it, the float's volume was 7.5 times greater than its volume when he started.

ד. For how many minutes did Amir inflate the float?

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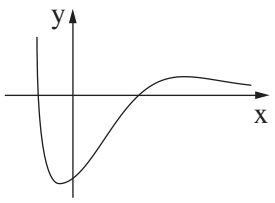
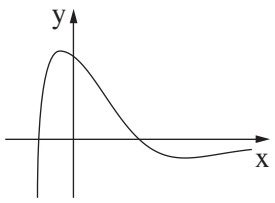
Part Two – Differential and Integral Calculus of Exponential and Logarithmic Functions

4. The function $f(x)$ and its derivative function $f'(x)$ are defined for all x.
Function $f(x)$ has only one maximum; the x-coordinate of this maximum is positive.
One of the two graphs below, I and II, describes the derivative function $f'(x)$.



II



I

א. Determine which of the graphs describes the derivative function $f'(x)$, and explain your answer.

We know that $f(x) = (x^2 - 2) \cdot e^{(-2x+1)}$.

ב. **(1)** Find the coordinates of the intersection points of the graph of function $f(x)$ with the x-axis.

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

ג. Sketch a graph of function $f(x)$.

Consider the function $g(x) = 7 \cdot e^{(-2x+1)}$, defined for all x.

ד. **(1)** Explain why function $g(x)$ is positive for all x.

(2) Find the coordinates of the intersection points of the graph of function $f(x)$ with the graph of function $g(x)$.

Through each point that you found in Item ד, we draw a perpendicular to the x-axis.

ה. Calculate the area of the region bounded by the graph of function $g(x)$, the x-axis, and the perpendiculars.

/Continued on page 5/

5. Consider function $f(x)=\frac{12x}{(\ell nx)^2}$.

א. **(1)** Find the domain [תחום ההגדרה] of function $f(x)$.

(2) Find the equation of the asymptote of function $f(x)$ that is perpendicular to the x-axis.

(3) Does the graph of function $f(x)$ have intersection points with the axes? Explain your answer.

ב. **(1)** Find the coordinates of the extremum [נקודת הקיצון] of function $f(x)$, and determine what type of extremum it is.

(2) Find the intervals on which function $f(x)$ is increasing.

ג. Determine which of the graphs I–IV at the end of this question describes function $f(x)$.

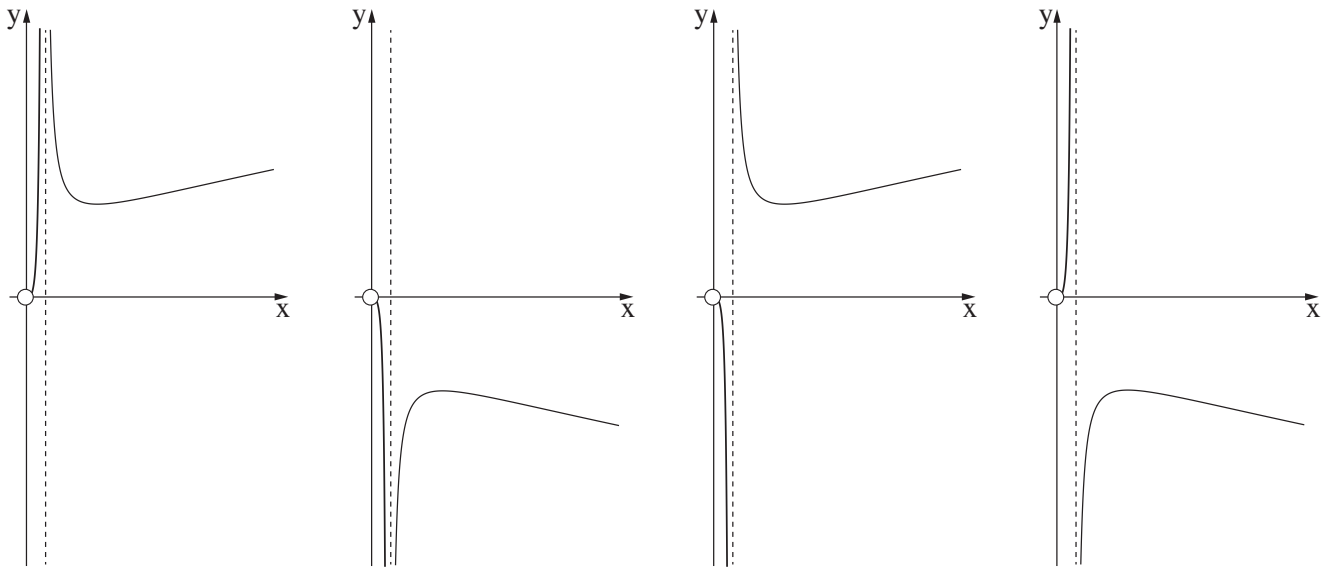
$g(x)$ is a function whose domain is identical to the domain of function $f(x)$.

The derivative of function $g(x)$ satisfies $g'(x)=f(x)-c$, c is a parameter.

ד. **(1)** For $c=4$, determine how many extrema function $g(x)$ has, and what type of extrema they are (if there are any).

Explain your answer.

(2) Give a value of c for which function $g(x)$ has three extrema. Explain your answer.



IV **III** **II** **I**

Good Luck!

בהצלחה!