



Mathematics

3 Points — 3rd Exam

מתמטיקה

3 יחידות לימוד – שאלון שלישי

Instructions

א. Duration of the exam: Two hours and forty minutes

ב. Exam structure and breakdown of points:

This exam has two parts, with a total of six questions.
You must answer four questions of your choice. Each question is worth 27 points.
The maximum number of points you can earn in total 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) **Write all your calculations and answers in the Hebrew exam booklet.**
Do not write in the margins.
- (2) 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.
- (3) Use the pages in the **Hebrew exam booklet** for draft work. If you use other paper for draft work, your exam may be disqualified.

הוראות

א. משך הבחינה: שתיים וארבעים דקות.

ב. מבנה השאלון ומפתח ההערכה:

בשאלון זה שני פרקים, ובהם שש שאלות סך הכול.
יש לענות על ארבע שאלות לבחירתכם
– לכל שאלה 27 נקודות.
סך הנקודות שתוכלו לצבור לא יעלה על 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) **יש לכתוב את כל החישובים והתשובות בנסח העברי של השאלון.**
אסור לכתוב על הפסים שבשוליים.
- (2) יש להסביר את כל הפעולות, כולל חישובים, בפירוט ובצורה ברורה ומסודרת. חוסר פירוט עלול לגרום לפגיעה בציון או לפסילת הבחינה.
- (3) לטייטה יש להשתמש **בדפים שבנסח העברי של השאלון**. שימוש בטייטה אחרת עלול לגרום לפסילת הבחינה.

Note: There is draft paper at the end of the Hebrew exam booklet. Do not add any other paper to the exam booklet.

שימו לב: בסוף הבחינה בעברית מצורפים דפי טייטה. אין להוסיף דפים אחרים למחברת הבחינה.

Good Luck!

בהצלחה!

Questions

Answer four of the questions 1–6 (each question – 27 points).

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

Write all your calculations and answers in the Hebrew exam booklet.

Part One – Linear Programming, Analytical Geometry

Finance and Economics

1. A candy factory produces two types of candies: toffee candies and gummy candies.

The candies are packed in bags.

One toffee candy weighs 5 grams and one gummy candy weighs 3 grams.

Each bag of candies must weigh at most 210 grams.

Each bag can hold at most 48 candies.

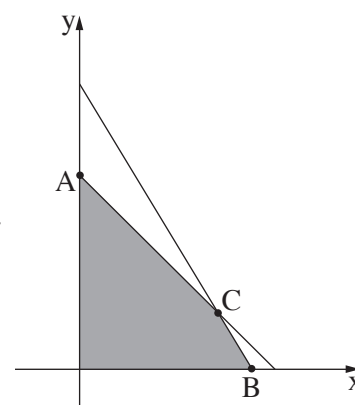
Let x denote the number of toffee candies in each bag

and let y denote the number of gummy candies in each bag.

- א. Write the system of constraints [מערכת האילוצים] for this problem.

The figure on the right shows the feasible region [התחום האפשרי] obtained from this problem's system of constraints.

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



The profit from selling one toffee candy is 0.5 shekels,

and the profit from selling one gummy candy is 0.4 shekels.

- ג. (1) Write the objective function [פונקציית המטרה] for the factory's profit from selling one bag of candies.
- (2) How many toffee candies and how many gummy candies should be packed in one bag for a maximum profit?

Two candy stores, Store A and Store B, ordered bags of candies from the factory.

The bags packed for Store A each contained 38 toffee candies (Store A did not order gummy candies).

The bags packed for Store B each contained the number of toffee and gummy candies that would yield the maximum profit for the factory.

- ד. By how many shekels was the factory's profit from selling one bag of candies to Store A less than the factory's profit from selling one bag of candies to Store B?

2. The figure to the right shows Quadrilateral ABCD .

Vertex A lies on the y-axis

and Vertex B lies on the x-axis.

Side BC is perpendicular to Side AB .

The equation of Side AB is $y = -\frac{1}{3}x + 2$.

א. Find the coordinates of Vertices A and B .

ב. Find the equation of Side BC .

Side CD is parallel to the x-axis.

We know that $D(3, 6)$.

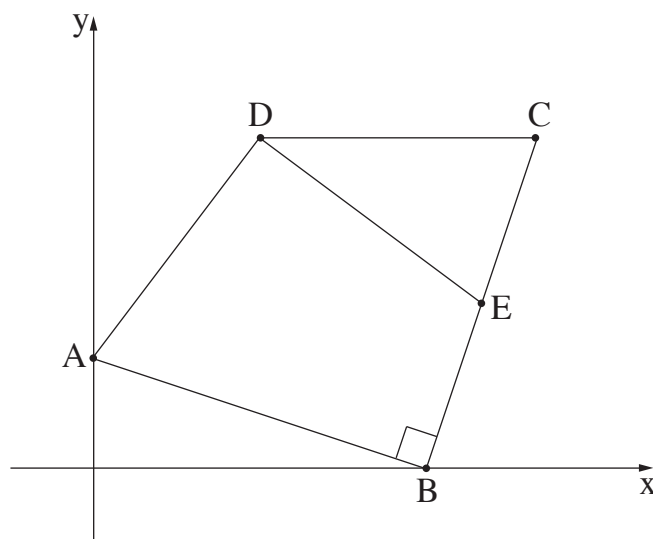
ג. Find the coordinates of Vertex C .

Point E is the midpoint of Side BC .

ד. (1) Find the coordinates of Point E .

(2) Show that Triangle EDC is an isosceles triangle [שווה שוקיים].

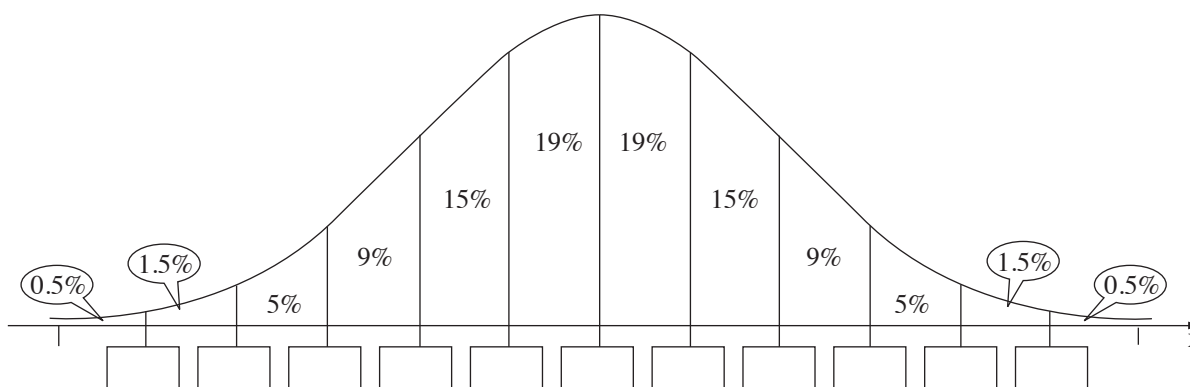
ה. Calculate the perimeter of Triangle EDC .



Part Two – Normal Distribution, Quadratic Model, Spatial Perception, Spatial Geometry

Society and Science

3. On a certain day, the amounts spent by customers at a large food store were normally distributed, with an average of 630 shekels.
- 84% of the customers that day spent less than 750 shekels each.
- א. (1) Find the standard deviation of the amounts spent that day.
- (2) A normal distribution curve is printed at the end of the question here, and in the Hebrew exam booklet.
- Fill the empty boxes of the graph in the **Hebrew exam booklet** with the appropriate values for the amounts spent.
- ב. Find what percentage of the customers that day spent more than 510 shekels and less than 750 shekels each.
- That day, 952 customers spent more than 510 shekels and less than 750 shekels each.
- ג. Based on the normal distribution curve, find how many customers in total shopped at the store that day.
- Every customer who spends more than 730 shekels at the store is eligible for a gift.
- Daniel went shopping there that day, and the standard score [ציון התקן] of the amount he spent was 0.8 .
- Daniel claims he is eligible for a gift.
- The cashier claims that he will be eligible for a gift if he buys an additional item that costs 5 shekels.
- ד. Determine who is right – Daniel, the cashier, or neither of them. Explain your answer.



4. A roller coaster was built on level ground in an amusement park.

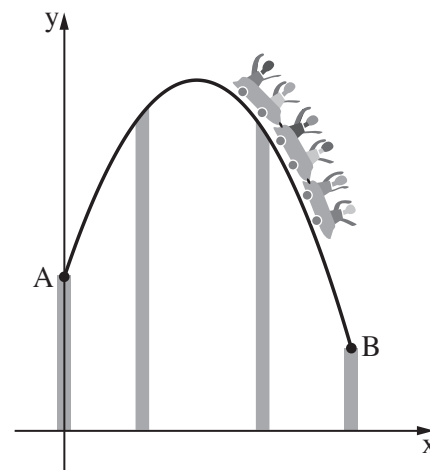
One section of the roller coaster track is parabola-shaped.

This section of the track starts at Point A on the y-axis and ends at Point B (see figure).

This section is described by the function $f(x) = -0.25x^2 + 3x + 7$.

The x-axis describes the horizontal distance (in meters) from Point A.

The y-axis describes the height of the track above the ground (in meters).



- א. Find the height above the ground of the starting point of this section of the track (Point A).
- ב. (1) Find the maximum height of this section of the track.
 (2) Find for which values of x on this section of the track the roller coaster is in an upward trend.

This section of the track is attached to several vertical support columns that are secured to the ground.

One of the columns is attached to this section of the track at Point B.

We know that the x-coordinate of Point B is 13.

- ג. Find the height of this support column.

Several automatic cameras are installed along this section of the track to photograph riders.

The cameras are located at points at which the height of the track above the ground is 12 meters.

- ד. Find the x-coordinates of the points at which the cameras are located on this section of the track.

Planar and Spatial Orientation

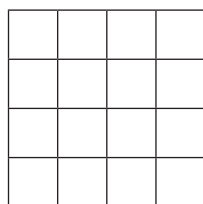
5. The figure to the right shows Structure I, which is built of identical cubes.

Each cube in the structure rests either on the surface or on another cube.

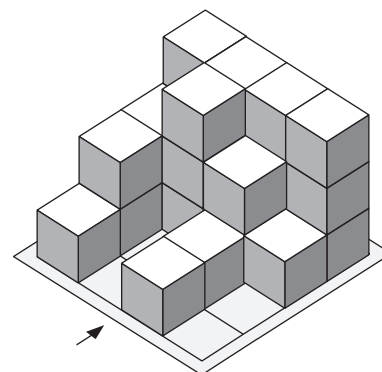
The arrow in the figure indicates the front view.

א. A template for Structure I appears below and in the Hebrew exam booklet.

Fill in the number chart [תרשים מספרים] for Structure I in the template in the **Hebrew exam booklet**.



Structure I



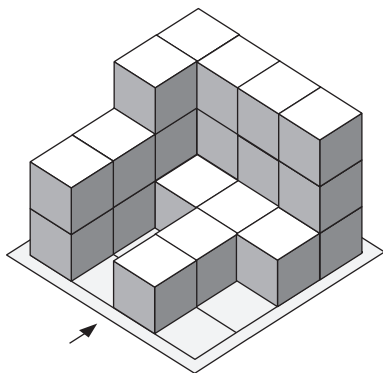
ב. Draw the right view of Structure I.

The figures below show two structures, II and III, that are built of identical cubes.

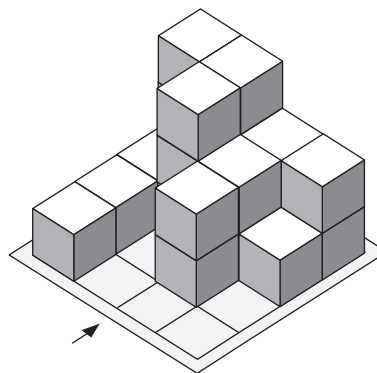
Each cube in each structure rests either on the surface or on another cube.

The arrows in the figures indicate the front view of each structure.

Structure III



Structure II



ג. Answer the sub-items (1)–(3) with regard to Structures I, II, and III.

- (1) Which structure has the smallest number of cubes? Explain your answer.
- (2) Which two structures have an identical top view?
- (3) Which two structures have an identical right view?

The smallest possible number of cubes needed to make the front view of all three structures identical were added to Structure II.

- ד. (1) How many cubes were added to Structure II?
- (2) Sketch a possible number chart for Structure II after the cubes were added.

6. Hadar has a cuboid-shaped fish tank.

The lengths of its base edges are 60 cm and 30 cm, and its height is 40 cm (see figure).

א. Find the volume of the fish tank.

Hadar wants to keep fish in the fish tank.

To maintain the quality of the water she has to install a filter in the tank.

The official standard requires that the volume of the filter must be at least 2% of the tank's volume.

Hadar is debating between two types of filters:

Filter A, which is cylindrical and has a base radius of 6 cm and a height of 18 cm (see figure), and Filter B, whose volume is $1,500 \text{ cm}^3$.

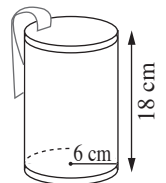
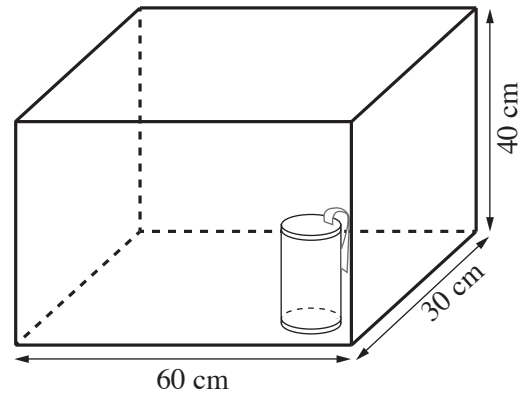
ב. (1) Find the volume of Filter A.

(2) Which of the filters A or B, or both, meet(s) the requirements of the official standard?

Explain your answer.

Hadar chose Filter A and installed it in the fish tank.

ג. What is the greatest volume of water that can be filled in the tank after Hadar installs Filter A in it?



Filter A

Good Luck!

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בהצלחה!

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