ÉRETTSÉGI VIZSGA • 2025. május 6.

MATEMATIKA ANGOL NYELVEN

KÖZÉPSZINTŰ ÍRÁSBELI VIZSGA

JAVÍTÁSI-ÉRTÉKELÉSI ÚTMUTATÓ

OKTATÁSI HIVATAL

Instructions to examiners

Formal requirements:

1. Mark the paper **legibly, in ink, different in colour** from that used by the candidate.
2. The first of the rectangles next to each problem shows the maximum attainable score on that problem. The **score** given by the examiner is to be entered **into the rectangle** next to this.
3. **If the solution is perfect,** enter maximum score and, with a checkmark, indicate that you have seen each item leading to the solution and consider them correct.
4. If the solution is incomplete or incorrect, please **mark the error** and also indicate the individual **partial scores**. It is also acceptable to indicate the points lost by the candidate if it makes grading the paper easier. After correcting the paper, it must be clear about every part of the solution whether that part is correct, incorrect or unnecessary.
5. Please, **use the following symbols** when correcting the paper:
   - correct calculation: *checkmark*
   - principal error: *double underline*
   - calculation error or other, not principal, error: *single underline*
   - correct calculation with erroneous initial data: *dashed checkmark or crossed checkmark*
   - incomplete reasoning, incomplete list, or other missing part: *missing part symbol*
   - unintelligible part: *question mark* and/or *wave*
6. Do not assess anything written **in pencil**, except for diagrams

Assessment of content:

1. The answer key may contain more than one solution for some of the problems. If the **solution given by the candidate is different**, allocate the points by identifying parts of the solution equivalent to those given in the answer key.
2. Subtotals may be **further divided, unless otherwise stated in the answer key**. However, scores awarded must always be whole numbers.
3. If there is a **calculation error** or inaccuracy in the solution, take points off only for the part where the error occurs. If the reasoning remains correct and the error is carried forward while the nature of the problem remains unchanged, points for the rest of the solution must be awarded.
4. **In case of a principal error,** no points should be awarded at all for that section of the solution, not even for steps that are formally correct. (These logical sections of the solutions are separated by double lines in the answer key.) However, if the erroneous information obtained through principal error is carried forward to the next section or the next part of the problem, and it is used there correctly, the maximum score is due for that part, provided that the error has not changed the nature of the task to be completed.
5. Where the answer key shows a **remark** in brackets, the solution should be considered complete without that remark as well.

6. Deduct points for **missing units** only if the missing unit is part of the answer or a unit exchange (without parentheses).
7. If there are more than one different approach to a problem, **assess only the one indicated by the candidate**. Please, mark clearly which attempt was assessed.
8. **Do not give extra points** (i.e. more than the score due for the problem or part of problem).
9. The score given for the solution of a problem, or part of a problem, **may never be negative**.
10. **Do not take points off** for steps or calculations that contain errors but are not actually used by the candidate in the solution of the problem.
11. **The use of calculators** in the reasoning behind a particular solution **may be accepted without further mathematical explanation in case of the following operations**: addition, subtraction, multiplication, division, calculating powers and roots, $n!$, $\binom{n}{k}$, replacing the tables found in the 4-digit Data Booklet (sin, cos, tan, log, and their inverse functions), approximate values of the numbers π and e, finding the solutions of the standard quadratic equation. No further explanation is needed when the calculator is used to find the mean and the standard deviation, as long as the text of the question does not explicitly require the candidate to show detailed work. **In any other cases, results obtained through the use of a calculator are considered as unexplained and points for such results will not be awarded.**
12. Using **diagrams** to justify a solution (e.g. reading data off diagrams by way of direct measurement) is unacceptable.
13. **Probabilities** may also be given in percentage form (unless stated otherwise in the text of the problem).
14. If the text of the problem does not instruct the candidate to round their solution in a particular way, any solution **rounded reasonably and correctly** is acceptable even if it is different from the one given in the answer key.
15. **Assess only two out of the three problems in part B of Paper II.** The candidate was requested to indicate in the appropriate square the number of the problem not to be assessed and counted towards their total score. Should there be a solution to that problem, it does not need to be marked. However, if the candidate did not make a selection and neither is their choice clear from the paper, assume automatically that it is the last problem in the examination paper that is not to be assessed.

I.

1.		
$A \cap B = \{5; 6\}$	1 point	
$B \setminus A = \{7; 8; 9\}$	1 point	
Total:	**2 points**	

2.		
$\left(\frac{68}{80} \cdot 100 =\right) 85$	2 points	
Total:	**2 points**	

3.		
$(5 \cdot 5 \cdot 5 =)$ 125	2 points	
Total:	**2 points**	

4.		
$x = 12$	2 points	
Total:	**2 points**	

5.		
(16 + 4 + 1 =) 21	2 points	
Total:	**2 points**	

6.		
The common ratio is (4 : 8 =) 0.5.	1 point	
The first term is ($8 : 0.5^2 =$) 32.	1 point	
The sum of the first 7 terms is $\left(32 \cdot \frac{0.5^7 - 1}{0.5 - 1} =\right) 63.5$.	2 points	32 + 16 +…+ 0.5 = 63.5
Total:	**4 points**	

7.		
There are a total of $\frac{7 \cdot 6}{2} = 21$ handshakes.	2 points	$\binom{7}{2} = 21$
21 – 10 = 11 handshakes are still about to happen.	1 point	
Total:	**3 points**	

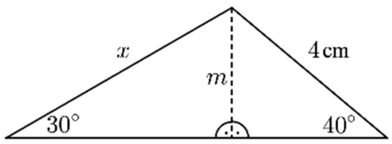
8.		
$\left(\frac{6}{4} \cdot 10 =\right)$ 15 cm	2 points	
Total:	**2 points**	

9.		
1110, 1101, 1011	3 points	
Total:	**3 points**	

Note: Award 1 point for each correct answer. Deduce a total of 1 point if the candidate lists incorrect number(s) as well as correct one(s).

10.		
$y = 2x + 1$	2 points	
Total:	**2 points**	

11. Solution 1		
(Let x be the length, in centimetres, of the missing side.) Use the Sine Rule: $\frac{x}{4} = \frac{\sin 40°}{\sin 30°}$.	2 points	
Then $x \approx 5.14$ cm.	1 point	
Total:	**3 points**	

11. Solution 2		
(Let m be the height, in centimetres, that belongs to the longest side of the triangle, and let the length of the missing side be x.)  $m = 4 \cdot \sin 40° \approx 2.57$	1 point	
$\sin 30° = \frac{2.57}{x}$	1 point	
$x \approx 5.14$ cm	1 point	
Total:	**3 points**	

12.		
There are a total $(8 \cdot 8 =)$ 64 equally likely possible outcomes.	1 point	
The number of favourable outcomes is four: 1-4, 2-3, 3-2 and 4-1.	1 point	
The probability is: $\frac{4}{64}\left(=\frac{1}{16}=0.0625\right)$.	1 point	
Total:	**3 points**	

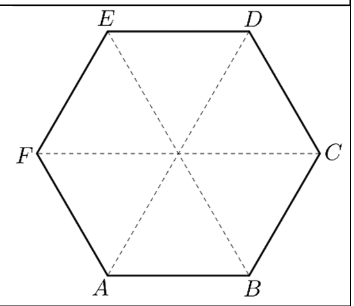
II. A

13. a)		
Apply a common denominator: $\frac{6x-6}{36}+\frac{4x+20}{36}=\frac{9x+27}{36}$.	2 points	*Award these 2 points if the candidate multiplies both sides of the equation by 36.*
Rearranged: $10x + 14 = 9x + 27$.	1 point	
$x = 13$	1 point	
Check by substitution or reference to equivalent steps.	1 point	
Total:	**5 points**	

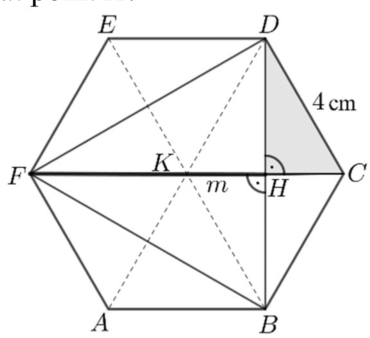
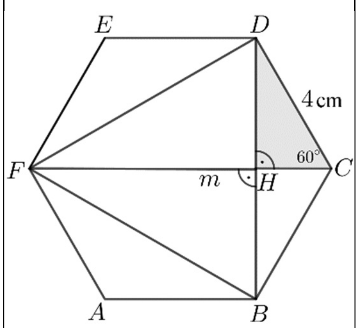
13. b)		
$x^2 + 2x + 1 + x^2 - 1 = 0$	2 points	$(x + 1)(x + 1 + x - 1) = 0$
$2x^2 + 2x = 0$	1 point	$(x + 1)\cdot 2x = 0$
$x_1 = 0,\ x_2 = -1$	2 points	
Check by substitution or reference to equivalent steps.	1 point	
Total:	**6 points**	

14. a) Solution 1		
The sum of the interior angels of a hexagon is $4 \cdot 180° = 720°$.	2 points	
(As all angles of a regular hexagon are equal,) the measure of one interior angle is $(720° : 6 =)\ 120°$.	1 point	
Total:	**3 points**	

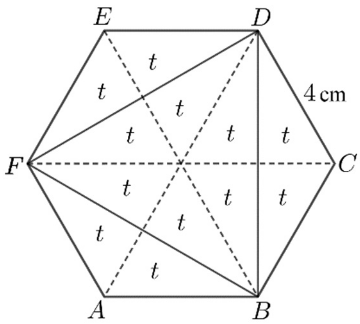
14. a) Solution 2		
The sum of the exterior angles of a hexagon is 360°.	1 point	
One exterior angle of a regular hexagon is $(360° : 6 =)\ 60°$,	1 point	
so the measure of one interior angle is, $(180° - 60° =)\ 120°$.	1 point	
Total:	**3 points**	

14. a) **Solution 3**		
The three (main) diagonals of a regular hexagon divide it into six congruent regular triangles.	1 point	
Each interior angle of which is 60°.	1 point	
The measure of one interior angle of the regular hexagon is then (2 · 60° =) 120°.	1 point	
Total:	**3 points**	

14. b) **Solution 1**		
(The measure of angle *BCD* is 120°.) Apply the Cosine Rule in the isosceles triangle *BCD*: $BD^2 = 4^2 + 4^2 - 2 \cdot 4 \cdot 4 \cdot \cos 120° = 48$.	2 points	
$BD (= \sqrt{48}) \approx 6.93$ cm $(= BF)$	1 point	
$A_{BDF\Delta} = \dfrac{BD \cdot BF \cdot \sin 60°}{2} = \dfrac{\sqrt{48} \cdot \sqrt{48} \cdot \frac{\sqrt{3}}{2}}{2} =$	1 point	$A_{BDF\Delta} = \dfrac{\sqrt{3}}{4} \cdot 6.93^2$
$= 12\sqrt{3} \approx 20.78 \text{ cm}^2$	1 point	
Total:	**5 points**	

14. b) **Solution 2**		
(The three diagonals passing through centre *K* of the regular hexagon divide it into six congruent regular triangles, making quadrilateral *BCDK* a rhombus. So) the line segment *BD* perpendicularly bisects the line segment *KC* at point *H*. 	1 point	*In the isosceles triangle BCD, point H is the midpoint of side BD.* 
Apply the Pythagorean Theorem: $DH = \sqrt{4^2 - 2^2} = \sqrt{12} \approx 3.46$ cm.	1 point	$\sin 60° = \dfrac{DH}{4}$ $DH \approx 3.46$ cm
$BD = FD = 2\sqrt{12} \approx 6.93$ cm	1 point	

Apply the Pythagorean Theorem in the regular triangle *BDF* to find its height: $m=\sqrt{6.93^2-3.46^2}\approx 6$ cm.	1 point	$m = 8 - 2 = 6$ cm
$A_{BDF\Delta}=\dfrac{6.93\cdot 6}{2}=20.79\text{ cm}^2$	1 point	
Total:	**5 points**	

14. b) Solution 3		
(A regular hexagon can be divided into 6 regular triangles, so) with the hexagon divided into 12 congruent right triangles, triangle *BDF* consists of 6 of these. 	1 point	
The area of triangle *BDF* is half the area of the regular hexagon.	1 point	
$A_{BDF\Delta}=\dfrac{1}{2}\cdot\left(6\cdot\dfrac{4\cdot 4\cdot\sin 60°}{2}\right)\approx$	2 points	
$\approx 20.78\text{ cm}^2$	1 point	
Total:	**5 points**	

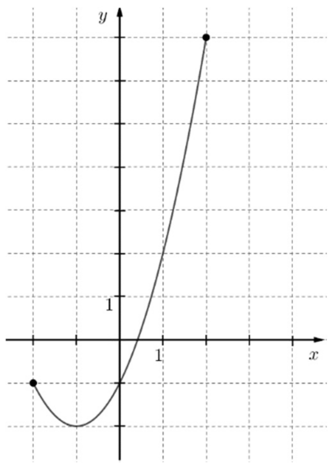
14. c)		
(The radius of the circumcircle of a regular hexagon is equal to the length of the side, so) $r = 4$ cm.	1 point	
The circumference of the circumcircle of the regular hexagon is $8\pi\approx 25.13$ cm.	1 point	
Total:	**2 points**	

14. d)		
$\overrightarrow{BF}+\overrightarrow{FD}=\overrightarrow{BD}$	1 point	
$\overrightarrow{AB}-\overrightarrow{AF}=\overrightarrow{FB}$	2 points	
Total:	**3 points**	

15. a)

$((-1.5+1)^2-2=)\ -1.75$	2 points	
Total:	**2 points**	

15. b)

The graph shows part of a parabola (opening up),	1 point	
defined over the interval [–2; 2].	1 point	
The vertex of the parabola is (–1; –2).	1 point	
Total:	**3 points**	

15. c)

	e	*g*
Has a zero.	true	false
Strictly monotone increasing.	false	true
Has a maximum.	false	false

(table above)	4 points	*Award 3 points for 5 correct answers, 2 points for 4 correct answers, 1 point for 3 correct answers. Do not award any points for less than 3 correct answers.*
Total:	**4 points**	

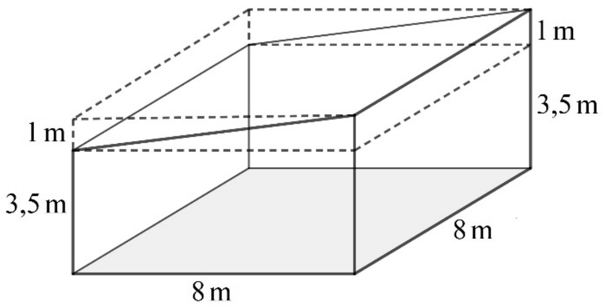
15. d)

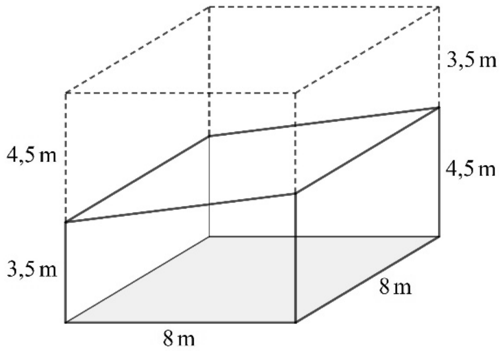
$2^x=3$	1 point	
$x=\log_2 3\left(=\dfrac{\log 3}{\log 2}\right)$	1 point	
$x\approx 1.585$	1 point	*Do not award this point if the candidate does not round their answer or rounds incorrectly.*
Total:	**3 points**	

II. B

16. a)		
90 cm = 0.9 m and 210 cm = 2.1 m.	1 point	
The surface of the wall with the door: $8 \cdot 3.5 - 0.9 \cdot 2.1 = 26.11$ m^2.	1 point	
The surface of the wall with the windows: $8 \cdot 4.5 - 3 \cdot 1.6 \cdot 2.5 = 24$ m^2.	1 point	
The total painted area: $24 + 26.11 = 50.11$ m^2.	1 point	
Total:	**4 points**	

16. b) Solution 1		
The shape of the classroom is a (right) trapezoid-based straight prism.	1 point	*Award this point also if this is not explicitly stated but apparent from the solution.*
The area of the trapezoid is: $A = \frac{(3.5 + 4.5) \cdot 8}{2} = 32$ m^2.	2 points	
The volume of the classroom is $V = 32 \cdot 8 = 256$ m^3.	1 point	
Total:	**4 points**	

16. b) Solution 2		
The volume of the classroom is the sum of the volumes of a cuboid and a right triangular prism.  	1 point	*Award this point also if this is not explicitly stated but apparent from the solution.*
$V_{cuboid} = 8 \cdot 8 \cdot 3.5 = 224$ m^3	1 point	
$V_{prism} = \frac{8 \cdot 1}{2} \cdot 8 = 32$ m^3	1 point	
The volume of the classroom is $V_{classroom} = 224 + 32 = 256$ m^3.	1 point	
Total:	**4 points**	

16. b) **Solution 3**		
Two of these classrooms, joined at their ceilings, would produce an 8 m × 8 m × 8 m cube,  	2 points	
the volume of which is (8^3 =) 512 m^3.	1 point	
The volume of the classroom is then (512 : 2 =) 256 m^3.	1 point	
Total:	**4 points**	

16. c)		
There are 1, 3, 5, 7, … names in the rows, respectively. These numbers form consecutive terms of an arithmetic sequence. The first term of the sequence is 1, the common difference is 2.	1 point	*Award this point also if this is not explicitly stated but apparent from the solution.*
Assuming the number of rows is n: $\frac{2\cdot 1+(n-1)\cdot 2}{2}\cdot n=196.$	1 point	
Rearranged: $n^2 = 196$,	2 points	
so (as $n > 0$) $n = 14$. (A total of 14 rows are required, which meets the conditions of the question.)	1 point	
Total:	**5 points**	

Notes:
1. Award 4 points if the candidate calculates 196 by listing and adding the first 14 terms of the sequence. A further 1 point is awarded for the correct answer.
2. Award full marks if the candidate gives the correct answer by referring to the sum of the first n positive odd numbers being n^2.

16. d) **Solution 1**		
Eszter and Csaba can sit at any of 3 desks, in 2 different orders each, which gives 6 possibilities.	2 points	*Eszter has a choice of 6 seats, while Csaba will have to sit next to her. This is 6 possibilities.*
The other four students may sit in 4! = 24 different orders.	1 point	
The total number of possible seating arrangements is, therefore, $6 \cdot 24 = 144$.	1 point	
Total:	**4 points**	

16. d) **Solution 2**		
The six students may sit in a total 6! different ways.	1 point	
Among these 6! seating arrangements, there is an equal number of cases in which the person sitting next to Csaba is Anna, Balázs, Dóra, Eszter or Fülöp. So Eszter is sitting next to Csaba in one fifth of the cases.	2 points	
The total number of appropriate seating arrangements is: $\frac{6!}{5} = 144$.	1 point	
Total:	**4 points**	

17. a)

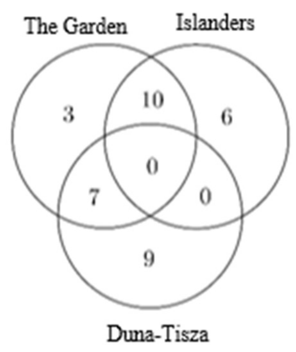
mini-mum	lower quartile	median	upper quartile	maxi-mum
2	3	4.5	5	5

(table above)	5 points	*Award 1 point for each correct value.*
Total:	**5 points**	

17. b)		
The mean: $\frac{2 \cdot 2 + 3 \cdot 3 + 2 \cdot 4 + 7 \cdot 5}{14} = 4$,	1 point	*Award these marks if the candidate correctly determines the mean and the standard deviation with a calculator.*
The standard deviation: $\sqrt{\frac{2 \cdot 2^2 + 3 \cdot 1^2 + 2 \cdot 0^2 + 7 \cdot 1^2}{14}} = \sqrt{\frac{18}{14}} \approx 1.13$.	2 points	
Total:	**3 points**	

17. c) **Solution 1**		
There are $\binom{14}{2}=91$ possible ways to select 2 customers out of 14 (total number of cases).	1 point	
There are 9 customers giving a rate of 4 or 5. There are $\binom{9}{2}=36$ ways to select 2 from among these 9 (number of favourable cases).	1 point	
The probability is: $\frac{36}{91}$ (≈ 0.396).	1 point	
Total:	**3 points**	

17. c) **Solution 2**		
If the order of selection is considered, there are $14\cdot 13 = 182$ ways to select 2 customers out of 14 (total number of cases).	1 point	*The probability that the customer first selected gives a rating of at least 4 is* $\frac{9}{14}$,
There are $9\cdot 8 = 72$ ways to select 2 out of the 9 customers giving a rating of 4 or 5 (number of favourable cases).	1 point	*the same probability for the second customer is* $\frac{8}{13}$.
The probability: $\frac{72}{182}$ (≈ 0.396).	1 point	*The probability is the product of the above:* $\frac{72}{182}$.
Total:	**3 points**	

17. d)		
The number of customers buying a single game only: *The Garden*: 3, *Islanders*: 6, *Duna-Tisza*: 9	2 points	
There is 0 in the common intersection of the three sets, and 10 in the intersection of *The Garden* and *Islanders* only.	1 point	
20 – (3 + 10 + 0) = 7 customers bought both *The Garden* and *Duna–Tisza*.	1 point	
16 – (6 + 10 + 0) = 0, so nobody bought only *Islanders* and *Duna–Tisza*.	1 point	
The game *Duna–Tisza* was bought by 9 + 7 = 16 customers.	1 point	
Total:	**6 points**	

Note: Award full marks if the candidate gives the correct answer based on the correct Venn-diagram.

18. a)		
The volume of the sink: $19^2 \cdot \pi \cdot 12 \approx 13\,609$ cm^3,	1 point	
which is 13.609 litres.	1 point	13 609 ml
3 days = $3 \cdot 24 \cdot 60 \cdot 60$ = 259 200 seconds.	2 points	
The amount of water dripping from the faucet is $\left(259\,200 \cdot \frac{1}{20} =\right)$ 12 960 ml.	1 point	
This is 12.96 litres, so the water will not spill from the sink in 3 days.	1 point	
Total:	**6 points**	

18. b) Solution 1		
Let *s* be the price of the dessert and let *f* be the price of a scoop of ice cream. Then: $\left.\begin{array}{l} 4s+2f=4100 \\ 2s+4f=3400 \end{array}\right\}$.	1 point	
From the first equation $f = 2050 - 2s$.	1 point	*Subtract the first equation from the double of the second:*
Substitute into the second equation and rearrange: $8200 - 6s = 3400$.	1 point	$6f = 2700$.
Then $s = 800$ (the price of a dessert is 800 Ft),	1 point	
and $f = 450$ (one scoop of ice cream costs 450 Ft).	1 point	
Check by substitution into the text.	1 point	
Total:	**6 points**	

18. b) Solution 2		
Over the course of 2 days András's family bought 6 desserts and 6 scoops of ice cream for a total of (4100 + 3400 =) 7500 Ft.	1 point	
They therefore paid (7500 : 6 =) 1250 Ft for one dessert and one scoop of ice cream.	1 point	
Considering their purchase on the first visit, 2 desserts cost $(4100 - 2 \cdot 1250 =)$ 1600 Ft.	2 points	
On dessert costs 800 Ft,	1 point	
one scoop of ice cream costs (1250 – 800 =) 450 Ft.	1 point	
Total:	**6 points**	

18. b) **Solution 3**		
András's family bought 6 items on both occasions.	1 point	
As they bought 2 more desserts (and 2 less scoops of ice cream) on the first occasion than they did on the second, and they also paid (4100 – 3400 =) 700 Ft more,	1 point	
a dessert must have cost (700 : 2 =) 350 Ft more than a scoop of ice cream.	1 point	
On the second occasion they bought 2 desserts and 4 scoops of ice cream for 3400 Ft, so the price for 6 scoops of ice cream is (3400 – 2·350 =) 2700 Ft.	1 point	
One scoop of ice cream then costs 450 Ft.	1 point	
One dessert costs 800 Ft.	1 point	
Total:	**6 points**	

18. c) **Solution 1**		
There are a total of 10·10·10 different ways for Bandi to select the flavours.	1 point	
A favourable case is when there is no pistachio among them at all, this is 9·9·9 possibilities,	1 point	
or when there is exactly one pistachio among the three scoops, which gives 9·9 cases if pistachio is the first, the same when it is second and also the same when it is third.	1 point	
The number of favourable cases is, 9·9·9 + 3·9·9.	1 point	
The probability is $\frac{9\cdot 9\cdot 9+3\cdot 9\cdot 9}{10\cdot 10\cdot 10}=0.972$.	1 point	
Total:	**5 points**	

18. c) **Solution 2**		
The probability that Bandi will select pistachio for a particular scoop is $\frac{1}{10}$. The probability that he will select some other flavour is $\frac{9}{10}$.	1 point	*Award this point also if this is not explicitly stated but apparent from the solution.*
The probability that there will not be any pistachio among the three scoops is $\left(\frac{9}{10}\right)^3$ (= 0.729).	1 point	
The probability that there will be exactly one pistachio among the three scoops is $\binom{3}{1}\cdot\left(\frac{9}{10}\right)^2\cdot\left(\frac{1}{10}\right)$ (= 0.243).	2 points	
The overall probability is the sum of these: 0.972.	1 point	
Total:	**5 points**	