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GENDER, GIFTED & TALENTED STUDENTS AT IRAN'S STATE UNIVERSITIES

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Abstract

“Giftedness” refers to a student’s outstanding ability in one or more domains (e.g. intellectual, creative, ...) and “talent” refers to outstanding performance in one or more fields within these domains (e.g. mathematics, science and technology, languages,...): that is talent emerges from giftedness as a consequence of the student’s learning experience. One of the most important problems that universities face in identifying gifted students. The basic question is that if there is any difference between boys and girls in mathematical giftedness. In the year 2007, Iran with the population of more than 71,000,000, had near 17,000,000 school students. The general obligatory education in Iran consists of five years of elementary school, three years of guidance school, plus one year of high school. After nine years of education at school, 39% of students enter the vocational schools according to their interests and the rest continue their high school educations in different branches which are the mathematics and physics, experimental science, human science and the art branches. By finishing Pre University at school, most of the students take part in nation-wide University Entrance Exam every summer to continue their education at state universities.

In 2007 more than 1,424,000 applicants took part in this exam and nearly 79,400 of them got accepted. Studying in state universities and using dormitories are free of charge which makes the competition for getting accepted in these universities harder. There are some extra facilities for gifted and talent students in the state universities.

Miller, 1990; Holton & Gaffney, 1994, had above indicators of Mathematical Giftedness and Yager, 1989, had defined indicators of scientific giftedness.

At first in this paper, by the use of introduced indicators, I have shown that the Entrance Examination is a proper criterion for identifying gifted and talented students. In addition, it will be noticed that gifted students in math group are mostly among boys while in the other groups, number of gifted girls is higher than boys.

Keyword: Gender, Gifted students, talented students, Mathematics, Entrance Examination,

1) Introduction

Iran had a population of more than 71000000 with about 17000000 students at 2007. Students in Iran have to attend primary school, guidance school, high school and pre university courses which take 12 years altogether⁽¹⁾. It's important to find and distinguish gifted students to provide a proper environment for them. Therefore 20 years ago, SAMPAD institute was established. At the beginning it started its working in three provinces of Iran and currently; it has 126 branches all around Iran. Most of gifted students are studying at these departments. It's so important to recognize and pay enough attention to these students at universities, too. In this paper, I try to show how we can recognize gifted students, and I also show that the Entrance Exam is an appropriate criterion to single out gifted students from other.

2) Methodology

The theory of intelligence and also being gifted and their definition is important, so in this section, it is presented.

2-1: definition of giftedness

In the past, it was common to know the giftedness equal to high IQ. It was believed that gifted students are born with high intelligence. These students get high scores at school, in university and are successful in different aspects of life. This belief still exist, but it is undergoing change, and new research is challenging the previous thoughts like the ones that have been done by "Howard Gardner" & "Robert Sternberg". "Robert Sternberg" suggested the theory of three dimensional intelligence in 1986:

These dimensions are:

- **Componential intelligence:**

Intelligence consists of mental mechanisms for processing information.

- **Experiential intelligence:**

Intelligence involves dealing with new tasks as situation and ability to use mental processes automatically.

- **Contextual intelligence:**

Intelligence is the ability to adapt to select and shape the environment ⁽²⁾.

Howard Gardner's Theory of Multiple intelligence is more widely known. He identified Eight Different types of Intelligence (Gardner, 1983 – 1999) Logical – Mathematical, Linguistic, Visual– spatial, Body- kinesthetic Musical, Interpersonal Intrapersonal and Naturalistic⁽³⁾.

They pay much more attention to mathematical and linguistic intelligence-or in their words to the scientific intelligence-during school and university periods. According to the findings of E. Winner (1996), we can assume that all children are gifted because dimensions of intelligence are so widespread. All children are gifted. This is a well – intentioned belief, and it is true that all children have areas of strength Nevertheless, it is a fact that some students learn more quickly and are capable of a higher level of work than their age peers. Gifted students need different content and instruction in order to meet their needs ⁽⁴⁾. Definition of “three ring” in Joseph S. Renzuli has developed a definition of giftedness, which consists of above- average ability, creativity and task commitment as motivation⁽⁵⁾. With respect to different dimensions of intelligence, mathematical and scientific intelligence are more important for the education of gifted students at school and university.

2-2) Determinations of gifted students

One of the most important issues in schools all around the world is identifying the gifted students. Some criteria like high scores in exams and previous records of

education are definitely proper criteria for choosing gifted students. The institutes which are training and educating gifted students represent various criteria. Two important groups of indicators could be represented as follows:

“R.E.Yager” had represented some indicators of scientific giftedness in 1989⁽⁶⁾:

Indicators of scientific giftedness:

- Strong curiosity about objects and environments
- High interesting investigating scientific phenomena
- Tendency to make observation and ask questions
- Ability to make connections between scientific concepts and observed phenomena
- Unusual ability to generate creative and valid explanations
- Interest in collecting, sorting, and classifying objects

“R.C.Miller” in 1990 & “M.Gaffny” & “D.Holtonc” in 1994 had represented these indicators for mathematical giftedness ⁽⁷⁾:

Indicator of Mathematical Giftedness

- Unusual curiosity about numbers and mathematical information
- Ability to see patterns and think abstractly
- the Use of flexible and creative strategies and solutions
- Ability to transfer a mathematical concept to an unfamiliar situation
- Use of analytical , deductive, and inductive reasoning
- Persistence in solving difficult and complex problems

3) Schools for gifted students in Iran & final exam

In most of the countries, governments and special institutes pay much more attention to choose the gifted students. Private schools in big countries like the U.S. and England and public institutes in Iran, Korea, and Australia, have been working on this issue for many years. In all over the world there are some

spatial programs for talented student. For example in the U.S., Project Lead The Way (PLTW) is a national non-profit organization established to help schools give students the knowledge they need to excel in high-tech fields. Studies of PLTW's curriculum have proven that PLTW students become the kind of prepared, competent, high-tech employees. The U.S. industry needs to stay competitive in the global market. With more than half of the country's engineers and scientists nearing retirement, and with more than half of the students in college engineering programs dropping out before graduation, the U.S. technical industries are in need of more than one million engineers and technical workers⁽⁸⁾.

Like other countries, there is a special attention to this case at primary school, high school, and university levels in Iran. In this paper it has shown that Entrance Exam makes choosing the gifted students possible, in different fields of science as well as mathematics. Getting into special schools for gifted students is so important for Iranian families. These schools have also entrance exams because of their popularity. The first factor for being permitted to take this exam is having an average more than 19 in your lessons (scores at schools of Iran are between 0 up to 20). So the average 19 is so high .lower than 5 percent of those who take this entrance exam, will be accepted and enter to these schools. The lesson topics and programs of these schools are the same as other schools in Iran. But there are some differences:

- Students in the same class have almost equal mental capacity.
- Qualified and professional instructors, teach in these schools.
- There are sidelong programs in math, English and also classes for preparation of physics, math, computer, chemistry olympiads and so on⁽⁹⁾.

3-1) High schools' Final exam during the senior year

In the last year of high school, students take part in a final exam which has similar questions for all of the students all around Iran. This exam is held at the end of every spring and about 650,000 students take part in it to get their diploma. It is a written exam and all of the answer sheets get corrected in a special center.

The questions in the final exam in math group are from the following courses:

1. Pertain literature
2. English
3. Islamic knowledge
4. Algebra
5. Geometry
6. Calculus
7. Physics
8. Chemistry
9. Arabic language

Score for each lesson is between 0 up to 20, and one should gain at least 10 out of 20 to pass that lesson. Because of publicity and being standard questions in this exam, the results could be a proper criterion for evaluating the scientific ability of the students.

The average of final exam is effective in university Entrance exam with a weight of 15 percent⁽¹⁰⁾.

4) Entrance Exam

Students with high capacity are fond of continuing their education in state universities of Iran in their favorite fields .Therefore students take the Entrance Exam to enter university. This exam is also a proper criterion for distinguishing genius students. Gifted and intelligent students in math field are known by this exam .Now I am going to introduce this exam and some of its questions.

Acceptance of students in public and private universities depends on the results of this exam. So every high school graduate who wants to enter the university, should take this exam .Studying in daily terms is free of charge and students have free dormitories as well. So the contest for these daily terms is so hard and rigid.

Table 1 show the number of students who took part in the exam and got accepted in public universities during the years of 1374-1386(1995-2007). ⁽¹¹⁾

percentage of the accepted students	Number of accepted students	Number of Participants students	year	row
4.8	61455	1277181	1995	1
4.6	58996	1259028	1996	2
5.1	63486	1541256	1997	3
4.6	60491	1295694	1998	4
4.2	56140	1340532	1999	5
4.3	57221	1339288	2000	6
4.1	58426	1431060	2001	7
4.3	62707	1455141	2002	8
4.3	62377	1450256	2003	9
4	57742	1436645	2004	10
4.7	65287	1389669	2005	11
5.15	73370	1343895	2006	12
5.57	79432	1424492	2007	13

Table 1 (Statistical Center Educational Measurement and Evaluation Organization)

With regard to this table, the percentage of the accepted students in daily terms of universities is under 6 in all these years. As we can see in 2007, 1424492 students take part in the Entrance Exam. Questions in Entrance Exam are designed for five different fields of study and each student can take part in one or two of them according to the lessons that he/she had taken during high school. In other words, students are divided into five groups & questions are different for each group.

These five groups are: math, experimental science, human science, art & foreign language s.

Table 2 shows the number of participant in each group:

male		female		percent	students	Group
percent	students	percent	students			
56.93	194803	43.7	147390	25.46	342193	Math
30.94	132634	69.06	296034	31.49	428668	Experimental science
34.52	179127	65.48	339708	38.61	518855	Human science
21.00	6223	79.00	23417	2.21	29640	Art
21.69	5326	78.31	19233	1.85	24559	foreign language
38.55	518113	61.45	825782	100.00	1424492	Total

Table2 (Statistical Center Educational Measurement and Evaluation Organization)

5) Lessons and scores in the Entrance Exam

In all groups, there are four general lessons which are Persian literature, Arabic language, Islamic knowledge, and foreign languages.

Main lessons in each group are:

- Mathematics, physics& chemistry in math group.
- Geology, math, biology, physics & chemistry in experimental science group.
- Economics, math, history, geography, philosophy & logic, psychology, sociology in human science group.
- Music, math, painting, art creativity in art group.

The questions are in the form of multiple choice and the sources of its questions are high school books. Number of questions and the weight of every lesson are shown in table 3.

Range of scores	weight	Valid time	Number of questions	Lesson
-33 to 100	4	18.75 min	25	Farsi literature
	2	18.75 min	25	Arabic
	3	18.75 min	25	Islamic knowledge
	2	18.75 min	25	English language
	12	85 min	55	Mathematics
	9	55 min	45	Physics
	6	35 min	35	Chemistry
	38	250 min	235	Total

Table 3 (Statistical Center Educational Measurement and Evaluation Organization)

Each correct answer has 3 positive score and each wrong answer has 1 negative score .The final score for each lesson score changes from -33 up to 100 percent. Then the percent of every lesson for a student, change to standard Z with cumulative frequency and Gaussian normal distribution curve, then with the relation 1, transfer it with the average of 5000 and standard deviation of 2250.

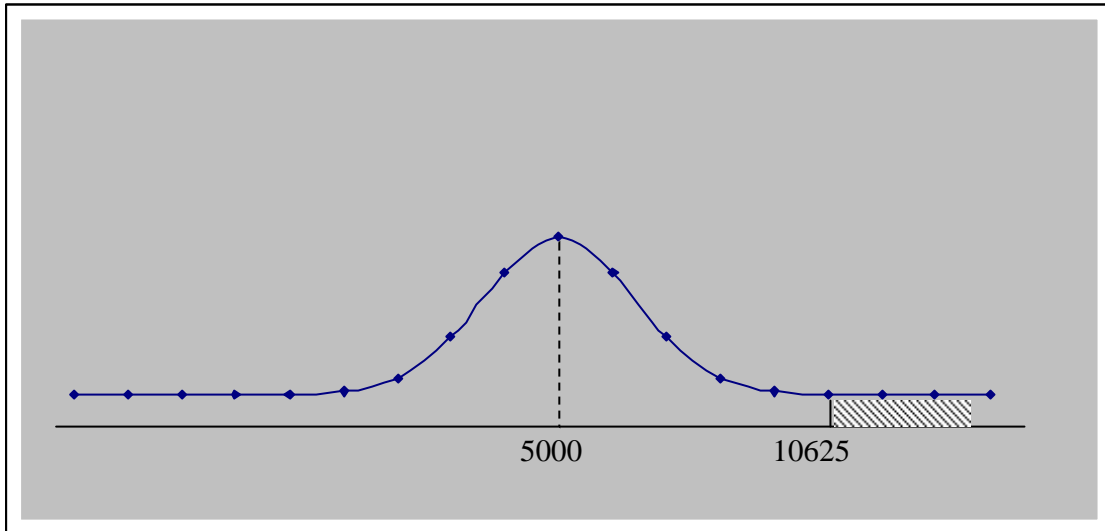
$$N_i = 5000 + 2250 Z_i \quad (1)$$

Total score of a student, compute with a weighted average:

$$NK_i = \frac{\sum n_i N_i}{\sum n_i} \quad (2)$$

n_i is the Wight of each lesson. In math group, we have a total score of all students (1,342,143 students) and the ones whom their total scores are more than 2.5 standard deviation of the average, are known as talented or gifted students. It means that every participant with the total score of more than 10625

is known as talented or gifted student. Total scores have normal distribution. The graph (1) shows the status of gifted students in the Gaussian curve:



Graph (1)

6) Number of talented students

The number and the percentage of talented male and female students in each group are shown in table (4). Out of 1,342,143 participants, 4,284 students are talented or gifted and their scores are higher than 10,625. In the math group, 74% of talented students are male and only 24% are female. However, 56/93% of participants are male and 43/7% are female. In experimental science and art groups, talented students to participants' ratio are almost the same in both male and female students. In human science and language groups, the number of talented students is higher among females.

Participant%		Talented	male		Female		Gender Group
male	female		No.	%	No.	%	
56/93	43/07	1368	1013	74%	355	26%	Mathematics
30/94	69/06	1898	586	30.9%	1312	69.1%	Experimental Science
34/52	65/84	937	255	27.2%	682	72.8%	Human Science
21	79	9	2	22.2%	7	77.3%	Art
21/69	78/31	72	25	34.7%	47	65.3%	Language
38/55	61/45	4284	1881	43.9%	2403	56.1%	Total

Table 4 (Statistical Center Educational Measurement and Evaluation Organization)

7) Comparing the scores of 100 top students in each group.

The table 5 shows the average scores of each lesson for top hundred students in each group. The average scores of math, physics and chemistry are higher among boys rather than girls. However, in other lessons girls are better than boys.

Math Group	Gender	Persian L.	Arabic L.	Theology	Foreign L.	Math.	Physics	Chemistry	Total Scores
	Female	841	814	875	856	905	884	879	12312
	Male	806	773	856	816	941	929	914	12557

Experimental Group	Gender	Persian L.	Arabic L.	Theology	Foreign L.	Geology	Math.	Biology	Physics	Chemistry	Total Scores
	Female	800	884	797	770	396	813	957	913	872	12614
	Male	775	895	765	779	483	860	952	922	882	12515

Humanity Group	Gender	Persian L.	Arabic L.	Theology	Foreign L.	Economics	Math.	Persian L.	Arabic L.	
	Female	890	855	825	684	406	841	901	847	
	Male	880	845	815	670	464	879	890	836	
						History & Geo.	Sociology	Philosophy	Psychology	Total Score
						765	901	804	921	12065
						755	895	820	904	11750

Table 5 (Statistical Center Educational Measurement and Evaluation Organization)

This result is the same as the previous result that I had gained in the paper “Gender and Mathematical Education” and I presented it in Copenhagen Denmark. ⁽¹²⁾

8) First 99 students in Math group:

Table 5 shows the total score of first 99 students in math group (2007). The highest score is 13,394 which is calculated by the use of second (2) formulas. Score of the last talented student is 10,625. The female students are shown by pink color in table 6.

nk	Total score	average	Math.
1	13394	19.80	1000
2	13350	19.76	976
3	13190	19.43	976
4	13142	19.03	982
5	13129	19.46	951
5	13004	19.54	982
7	12884	19.77	976
3	12853	19.65	982
9	12841	19.01	957
0	12835	19.64	976
1	12822	19.91	963
2	12735	18.80	1000
3	12724	19.78	908
4	12723	19.89	976
5	12707	19.50	976
6	12702	19.52	926
7	12698	19.76	933
8	12672	19.29	1000
9	12665	19.45	939
0	12652	19.49	951
1	12633	19.57	951
2	12628	19.46	982
3	12613	18.95	926
4	12613	19.54	951
5	12566	18.46	889
6	12552	19.80	957
7	12545	19.52	926
8	12531	19.71	976
9	12524	19.39	914
0	12507	19.29	939
1	12494	19.76	871
2	12491	19.69	889
3	12487	19.87	933
4	12484	19.71	976
5	12483	19.20	957

rank	Total score	average	Math.
36	12481	19.13	951
37	12477	18.83	951
38	12473	19.17	951
39	12444	19.25	976
40	12426	19.81	976
41	12422	19.61	982
42	12412	19.48	957
43	12411	18.26	963
44	12390	19.63	920
45	12384	19.68	945
46	12369	19.09	976
47	12368	19.45	976
48	12355	19.01	908
49	12352	19.92	902
50	12340	19.16	920
51	12333	19.50	908
52	12303	19.41	945
53	12301	18.75	976
54	12300	19.58	963
55	12283	19.63	877
56	12263	19.15	939
57	12241	18.62	871
58	12236	19.73	957
59	12233	19.20	933
60	12228	19.75	871
61	12227	19.25	951
62	12225	18.37	902
63	12212	19.23	840
64	12199	19.65	933
65	12192	19.84	920
66	12176	19.59	902
67	12168	19.43	926
68	12167	19.87	889
69	12163	19.46	741
70	12157	17.83	933

rank	Total score	average	Math.
71	12149	19.74	933
72	12134	19.14	846
73	12125	19.54	933
74	12124	19.42	871
75	12103	19.28	939
76	12103	19.69	908
77	12085	19.65	939
78	12083	19.37	920
79	12074	19.20	852
80	12066	19.64	914
81	12066	18.62	883
82	12055	19.56	840
83	12053	19.18	871
84	12037	19.47	889
85	12036	19.58	877
86	12034	19.53	926
87	12030	19.25	926
88	12027	19.50	772
89	12022	19.47	896
90	12019	18.88	920
91	12011	19.14	821
92	12007	19.53	828
93	12002	19.63	976
94	12001	19.64	859
95	11996	19.55	815
96	11989	19.72	834
97	11989	19.68	834
98	11989	19.68	834
99	11984	19.62	939

Table 6 (Statistical Center Educational Measurement and Evaluation Organization)

The average column shows the average of his final exam's scores in high school. We can see that most of the averages are more than 19. Second column, is the total scores which is calculated from relation two. Correlation between two these scores are high. The last column shows the score of 55 math questions.

9) Math Question in math group

Now the math questions in 2007 will be surveyed. These questions are divided in three levels, easy, medium and hard. Questions are from geometry, analytic geometry, algebra, linear algebra, matrix trigonometry, statistics, probability and calculus.

We see that these are a collection of all topics in mathematics which is taught at high school and Pre-University. There are 55 questions and valid time is 85 minute. (94 seconds for each question)

Questions are available at www.sanjesh.org

Table 7 shows the scores of top students in mathematics:

Score	Blank	No. In Correct	No. Correct
100	0	0	55
982	1	0	54
975	0	1	54
964	2	0	53
958	1	1	53
952	0	2	53
945	3	0	52
927	0	3	52

788	5	5	45
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Table7

9-1) Properties of Math Question and some sample:

The mathematical questions of math group in Entrance Exam have the following properties:

1. There are 55 questions that participants must answer within 85 minutes which means the average time for answering each question is approximately 1': 33".
2. These questions are taken out of school books that students had been studying during three years of high school and one year of pre-university education.
3. The questions are divided into three levels according to their difficulty. The first group of questions is the easiest one and almost all of the students who are prepared for the exam can answer them. The second group of questions is a bit harder fewer students can answer them and only the creative and advanced students can answer the third group of questions which are much more difficult. These questions are new for the students, very hard to be answered within limited time, and answering them makes a huge difference in the result of the exam. The third group indicates gifted students who aren't familiar with these types of questions yet they are able to solve them fast and correctly. These types of questions have also long term effects on teaching and learning mathematics, too. Once a new type of question appears in the exam, it is going to be on the top list of math topics for the students who want to take part in the next year Entrance Exam. They try to find out the shortest solutions for solving these problems and they also expect their teachers to be able to help them on these questions. Therefore, they are really challenging for both students to be able to answer them and

teachers to be aware of them. Finally, you can see some sample questions of University Entrance Exam in here.

1) In which this equation would has two real roots with inverse value.

- 1)2 2)3 3) -2 4)-3

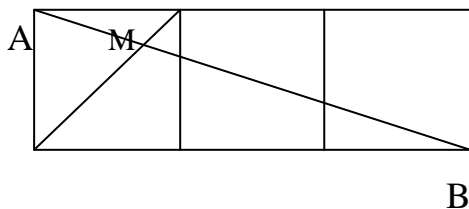
2) If a, b and c were the roots of equation $2x^3 - x^2 - 5x - 2 = 0$, what is the value of $a^2 + b^2 + c^2 + \frac{3}{4} abc$?

- 1)5 2)6 3) 7 4)8

These two questions are easy and they come in the first group of question that we had mention before.

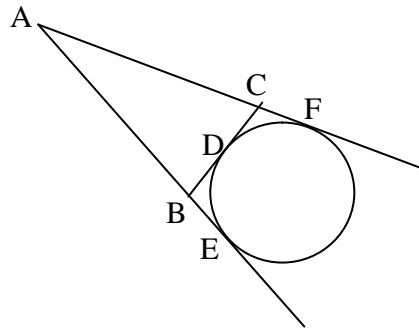
Students in high school have two years of Euclidian Geometry. The teaching of geometry is very important, especially because it familiarizes students with inferential reasoning. On the other hand, it enables students to observe and perceive the relationship between pure and applied mathematics through utilizing the coordinates. Students should answer each question within one minute. Some examples of the question are given:

3) In this figure three squares with same length (1cm) are shown, the distance MA how many times as much as BM?



- (1) 1/3
(2) 1/4
(3) 2/9
(4) 1/5

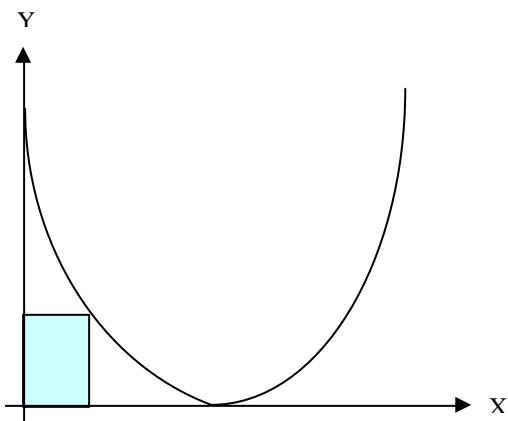
4) In the below figure point of tangency D on the circle moves between two fixed points E and F, how are the area and circumference of the ABC triangle?



- (1) circumference changes- area changes
- (2) circumference changes- area is fixed
- (3) circumference is fixed- area is fixed
- (4) circumference is fixed- area is fixed

5) Two sides of a rectangle correspond on coordinate axes, fourth vertex lies on the curve $y=(x-2)^2$ with interval $[0-2]$, what is the maximum area of this rectangle?

- 1) $11/9$
- 2) $32/27$
- 3) $10/9$
- 4) $28/27$



These three questions are a bit harder and they are in the second group of questions.

6) We have chosen two numbers between (0-2) randomly, what is the probability of their quotients to be less than $1/3$?

- 1) $1/9$ 2) $1/6$ 3) $1/4$ 4) $1/3$

Solution: The sample space is;

$$S = \{ (x, y) \mid 0 < x < 2 \text{ \& } 0 < y < 2 \}$$

The given outcome is

$$A = \{ (x, y) \mid x/y < 1/3 \text{ or } y/x < 1/3 \} = \{ (x, y) \mid y > 3x \text{ or } y < 1/3 \}$$

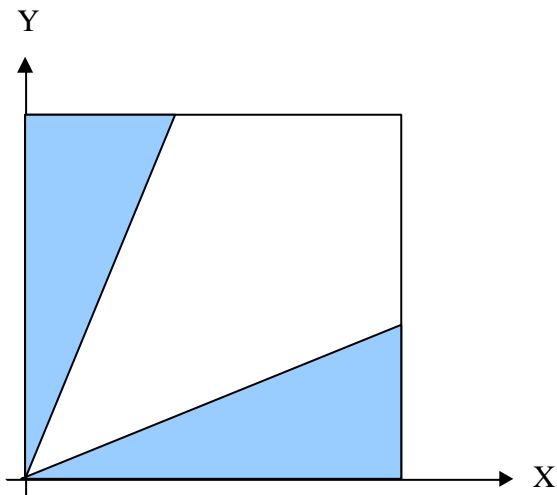
The sample space S and outcome A (shaded area) are shown in the figure,

$$P(A) = (S_1 + S_2) / S$$

$$S_1 = S_2 = 2/3$$

$$S = 4$$

$$P(A) = (2/3 + 2/3) / 4 = 1/3$$



Thus the answer (4) is correct. This question belongs to the third group

7) In triangle ABC, two vertices B and C are fixed, the vertex A is moving, $\angle A = 60^\circ$, $BC = 6$ cm. The bisector of the angle A passes from point D. Find the segment BD.

- 1) $6^{1/2}$ 2) $3^{1/2}$ 3) $2(3)^{1/2}$ 4) 4

This question belongs to the third group and it is the hardest one and it makes challenges. The answer (3) is correct, why?

At first, the students must understand that the two fixed vertices “B & C” and the moving vertex “A” are on the circumcircle (Fig a). Now, where is the point D that bisector “A” passes through? It should be understood that while the vertex “A” moves on the major arc “BC”, the bisector will always pass through the middle of minor arc “BC”. Thus the point “D” is on the circle circumcircle and its position is fixed (fig b). For measuring the length of BD, there are two approaches:

1st approach:

We have: $\text{arc } BD = 60^\circ$ and the length of BD equals to a side of equilateral hexagon, thus $BD = R$, when the R is radius of the circle.

From Sin formula we have: $BC / \sin A = 2R$? $6 / \sqrt{3}/2$? $R = 2\sqrt{3} = BD$

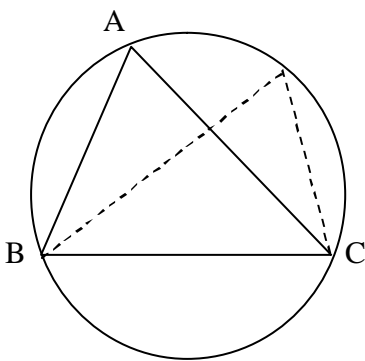


Figure a

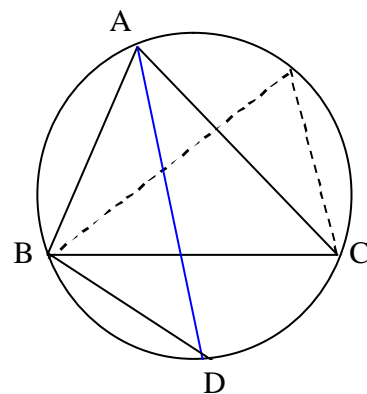


Figure b

2nd approach:

As vertex A moves on circumcircle, B and D are fix, thus length of BD is invariant. When A, reaches the midperpendicular of BC, the triangle ABC, becomes equilateral, and then $AD=2R$, and angles, $DAB=30^\circ$, $BDA=60^\circ$, $ABD=90^\circ$, therefore $BD=1/2AD=R$.

From Pythagoras' theorem in triangle ABD ' $R=2(3)^{1/2}$.Thus answer (3) is correct.

Reference:

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