

MATHEMATICS

The purpose of this document is to outline the knowledge and skills tested in the SSE Riga Admissions Test Mathematics part. Along with the specific subject areas examples are provided. Please note that the examples are just an illustration of the concepts. Actual exam problems may be different and combine the aspects of multiple subject areas. Also, particularly for problems covering the solving of equations and inequalities domain restrictions might be relevant.

Elementary Arithmetics

- Addition
- Subtraction
- Multiplication
- Division

Find the value $1 - (2 \cdot 2 \cdot 2 - 3 \cdot 2) - 2(2 \cdot (-1) - 5)$

Standard order of operations

Properties of fractions

Fraction operations

Find the value $\frac{1}{14} - \left(\frac{1}{2} - \frac{5}{7}\right)\left(-\frac{1}{2}\right)$

Exponentiation

- Properties of powers

Simplify $\frac{1}{2}\sqrt{196} - 5\sqrt{0,64}$

- Integer powers
- Rational powers
- Square roots
- n-th roots

Simplify $\left(\sqrt[6]{8^5}\right)^2 \left(\sqrt[3]{8^4}\right)^{-1}$

- Properties of logarithms

Find $\log_2 17 - 4\log_2 34 + 1,5\log_2 \frac{289}{2}$

Algebraic operations

- Algebraic sum
- Multiplication
- Exponentiation

Find $7 - (4 - 5)(7 - 11) - 6$

Factorize $(2a - 3b)^2 - 4b^2$

Simplifying algebraic expressions

Simplify $\frac{2x^2 - x - 15}{2x + 5}$

Elementary Algebra

- Simplifying rational algebraic expressions

Simplify $\frac{a - b}{\frac{1}{a} - \frac{1}{b}}$

- Factorization of algebraic expressions
 - Using factoring formulae
 - Using polynomial roots
 - By using a common

Factorize $(2a - 3b)^2 - 4b^2$

Factorize $x^2 - x - 30$

Factorize $a^2 + ab + ac + bc$

factor

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- Solving equations
 - Linear equations $Solve \begin{cases} x + y = 4 \\ x - 3y = 6 \end{cases}$
 - Systems of linear equations
 - Equation of a straight line $Write\ an\ equation\ of\ the\ straight\ line\ that\ passes\ through\ (-5, 5)\ and\ is\ parallel\ to\ the\ line\ with\ equation\ 2x + 5y = -10.$
 - Quadratic equations $Solve\ \frac{1}{x^2} = \frac{2}{1-x}$
 - Biquadratic equation $Solve\ -2x^4 + 10x^2 - 8 = 0$
 - Higher order equations solvable by factoring
 - Exponential equations $Solve\ 2^{2x} - 40 \cdot 2^x + 256 = 0$
 - Logarithmic equations $Solve\ \log_a(x-3) + \log_a(x+3) = \log_a 7$
 - Higher order equations solvable by factoring $Solve\ \cos^3(x) + 2\cos^2(x) + \cos(x) = 0$
 $0 \leq x < 2\pi$
 - Trigonometric equations
- Solving inequalities
 - Linear inequalities $Solve\ -7x \geq 14$
 - Quadratic inequalities $Solve\ -x^2 + 5x - 6 > 0$
- Trigonometry
 - Double angle formulae $Solve\ \frac{\sin(2x)}{\cos(x)} - \cos^2(x) = \sin^2(x)$
 - Symmetry and periodicity of trigonometric functions $Find\ \sin(0,1\pi) + \sin(1,1\pi)$
 - Unit circle

LOGICAL APTITUDE

The logical aptitude part of the admissions exam strives to assess logical reasoning of the applicant. The aim is to test applicant's numerical reasoning and general intelligence by using such tests as number series and quantitative estimations, as well as non-verbal reasoning test. Applicants can use the Internet resources to prepare for this part of the admissions tests.

Example Question I

Identify the missing number in the series.

	A	B	C	D	E
1. 4, 8, 16, 32, ?	48	64	40	46	44
2. 3, 6, 11, 18, ?	30	22	27	29	31
3. 4,3,5,9,12,17?	32	30	24	26	22

Answers

1. B – The numbers double each time
2. C – The interval, beginning with 3, increases by 2 each time
3. D – Each number is the sum of the previous and the number 3 places to the left

To solve these number sequence questions efficiently, you should first check the relationship between the numbers themselves looking for some simple arithmetic relationship. Then look at the intervals between the numbers and see if there is a relationship there. If not, and particularly if there are more than 4 numbers visible, then there may be two number sequences interleaved. You will occasionally find multiplication, division, or powers used in these sequences, but test designers tend to avoid them as these operations soon lead to large numbers which are difficult to work out without a calculator.

Example Question II

You need to estimate the answers to these questions, as you do not have time to calculate them precisely.

	A	B	C	D	E
1. $347+198=$	650	550	580	590	600
2. $69 \times 70=$	490	4650	5000	4800	4600
3. $905 \div 49=$	18	14	13	15	12

Answers

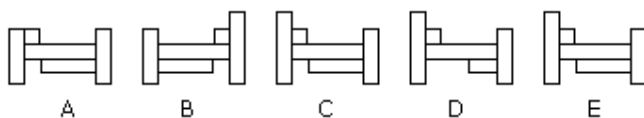
1. B
2. D
3. A

Even though numerical estimation questions appear straightforward, it can take some time to develop the optimum compromise between speed and accuracy. Before you attempt to answer each question, look at the range of answers available and ask yourself how accurate your estimate needs to be. For example, is an order of magnitude sufficient or does the answer need to be worked out to the nearest whole number?

If you are out of practice with arithmetic, then try re-learning the times tables up to 12 and practice rough and ready multiplication, division and percentage calculations. Practice can improve your test scores for all types of aptitude tests but numerical estimation is one area where it can really make a difference, so try as many examples as you can.

Example Question III

Which two pictures are identical?



Answer

C and E are the only two pictures which are identical

The best strategy for these types of question is to begin with the shape on the left and work through the shapes to the right of it systematically looking for an exact match. If there isn't one then move on to the second shape and repeat the process. It can be quite difficult to discipline yourself to adopt this systematic approach to these types of question, as you may think that it is quicker just to look at all of the shapes until the answer 'jumps out' at you. The problem with this is that if the answer doesn't 'jump out' fairly quickly then panic sets in and you usually resort to the systematic approach anyway.

[Source of examples and clarifications: <http://www.psychometric-success.com/>]

SSE Riga Admissions exam: English language

The English language part of the admissions exam is divided into two sections: 1) reading comprehension, 2) grammar, and 3) essay. In the reading comprehension part, applicants are given a recent news report from a major English-language newspaper or magazine and then asked ten multiple choice questions about its content. The following is the news report that was used in the 2010 admissions exam:

Guiding Lights

On most measures of the strength of a community's social fabric, the town of Oakdale would score poorly. There's the high divorce rate and appallingly low incidence of marital fidelity, the off-the-charts frequency of assault, murder, rape, and arson; the overlapping epidemics of kidnapping, identity theft, fraud, and wedding-day bridal abandonment. And there is a local justice system seemingly bent on imprisoning the innocent, leaving it up to intrepid family members and lovers to bring the truth to light.

Thankfully, no one lives in Oakdale, no one real. It is the fictional town where "As the World Turns," America's longest-running current soap opera, has unfolded for over half a century (this season will be its last). And while the dysfunction of Oakdale is what makes it so entertaining to its loyal fans, few would describe it as a place where people live exemplary lives. Soap operas, after all, are entertainment at its least believable and least nutritious.

The possibility, therefore, that people might be modelling themselves after characters on soaps might seem both farfetched and frightening. Recent research, however, suggests that, all over the world, that's exactly what's happening. What's more, we should be happy about it.

Soaps, it turns out, are shaping behaviour in ways that are subtle, profound and, from the standpoint of global development experts, positive. A team of economists credits Brazilian TV "novelas" for helping to dramatically lower a fertility rate that in 1960 was above six births per woman. Others have found that in India — where soaps dominate the airwaves — villages where people watch more TV give more responsibilities and rights to women and girls.

For years, experts on Brazil struggled with a riddle: throughout the second half of the 20th century, the number of babies being born to Brazilian mothers dropped far faster than traditional explanations suggest they should have, from 6.3 in 1960 to 2.3 in 2000. This was widely seen as a good thing — fewer children per family meant more resources per child, and it eased the entry of young women into the workforce and political life.

The question was why it had happened. Whereas China, for example, had resorted to a strict one-child policy to accomplish a similar reduction, Brazil's government had been deeply resistant to measures to lower birth rates.

A few years ago, reading anthropological research, Eliana La Ferrara, a developmental economist at Italy's Bocconi University, noticed accounts from poor Brazilian women about how they decided how many children to have. One of the reasons caught her attention: they said they wanted their families to be more like the smaller (and wealthier) families they saw on Brazil's popular soap operas.

If it seems unlikely that soap operas could have this much influence, consider that in Brazil, serial television dramas are a national obsession: the most popular have big budgets, far better writing and production values than American soaps, and can draw upwards of 80 million viewers in a nation of 190 million. Marquee football matches are scheduled so that they don't overlap with the prime-time novelas.

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La Ferrara, along with Alberto Chong and Suzanne Duryea of the Inter-American Development Bank, set out to see whether novelas did indeed help drive this large demographic change. The researchers used historical data, tracing the entry of Rede Globo — the network that creates the majority of Brazilian novelas — into different regional markets and matching that up with census data on births.

What they found was that, in region after region, when Rede Globo and its novelas arrived, births went down. And the researchers found another change, too: in those same regions, the children who were born were disproportionately named after characters on novelas. Young potential parents weren't just watching television, they were watching novelas, and identifying strongly with the characters. For all of their contrivances, the novelas work as entertainment, La Ferrara points out, because their viewers see the characters as members of their own familiar, actual lives, and that makes behaviours from the shows contagious with their viewers.

"You put something in a show and it's as if people were talking to their friends, they tend to be a little more inclined to see these things as part of life as opposed to a message or teaching or whatever," La Ferrara says.

The effect was not overwhelming, La Ferrara emphasizes, but it was significant. More educated women generally have fewer children than less educated women, and she calculates the novela effect as comparable to giving a woman two extra years of education.

Researchers have found a similar effect on the other side of the world, in rural India. Two economists, Emily Oster at the University of Chicago and Robert Jensen at UCLA, looked at surveys on a range of social attitudes in five Indian states from 2001 to 2003, a time of rapid expansion in access to cable TV. As with Brazil's Rede Globo, Oster and Jensen found that the spread of cable brought down the fertility rate, but they found other changes as well: Women with cable access were less approving of the idea that a husband could justifiably beat his wife, and reported having more autonomy and more of a role in household financial matters. Their daughters were more likely to be enrolled in school.

And while the study didn't look specifically at what viewers watched, Oster points out that soap operas are overwhelmingly the most popular programming on Indian television. As in Brazil, they tend to portray lives that are urban and upper-middle class, in which the female characters often work outside the house and manage their own affairs — lives that, to many Indian women, are becoming something to aspire to.

"There are differences between urban and rural areas in India in their attitudes toward women," Oster says, "and our estimates suggest that giving people TV in rural areas moves them between 50 and 70 percent of the way from rural to urban attitudes."

Oster and La Ferrara both readily concede that their work only measures a tiny sliver of the potential changes in attitudes and behaviour that soap opera viewers might exhibit — and that not all of those other changes might be healthy ones. Soap operas and novelas are full of all sorts of antisocial behaviour, even on the part of the heroes: a dangerous susceptibility to erotic impulses, a predilection for vigilante justice, an openness to being fooled, at least initially, by villainous suitors and step-parents. There's no research to determine whether viewers are in some small way absorbing these tendencies, as well.

And not everyone might see the changes the researchers recorded as positive. For example, in Brazil, exposure to Rede Globo and its novelas seemed to lead to an increase in the divorce rate among viewers. For women who might previously have stayed in an abusive relationship, that can be a good thing. But policymakers and scholars concerned about family stability aren't likely to see higher divorce rates as an encouraging sign.

Adapted from Drake, B. (2010, May 2). Guiding Lights. *Boston Globe*.

Here are three of the questions 2010 applicants were asked about this article:

1. What was puzzling about Brazil's declining birth rate?
 - a. It lasted forty years.
 - b. There was no apparent reason for it.
 - c. Many people actually saw it as a good thing.
 - d. China had taken similar measures as Brazil, but this didn't lead to quite the same decline.
2. The researchers believe that as Indians watch soap operas, they are more likely to...
 - a. move to urban areas
 - b. enter the upper-middle class
 - c. think like city dwellers
 - d. understand class differences
3. Which of the following does the article NOT cite as an example of problematic behaviour found in soap operas:
 - a. jealousy
 - b. gullibility
 - c. lack of self-control
 - d. taking the law into one's own hands

The correct answer to the first question is **b**. This is apparent in the sixth paragraph, where it is emphasised that "the question was why it had happened". Though a. and b. are presented as facts about Brazil's declining birth rate, they are not presented as puzzling. Option d., meanwhile, is not even presented as a fact, though China is mentioned.

The correct answer to the second question is **c**. This becomes apparent in the fifteenth paragraph: "our estimates suggest that giving people TV in rural areas moves them between

50 and 70 percent of the way from rural to urban attitudes." There is nothing about physically moving to urban areas, and though class is mentioned, there is nothing about entering a new class or the likelihood of understanding class differences.

The correct answer to the third question is **a**. If we look in the sixteenth paragraph, gullibility is cited ("an openness to being fooled") as are lack of self-control ("a dangerous susceptibility to erotic impulses") and taking the law into one's own hands ("vigilante justice"). There is no mention of jealousy.

The grammar section poses twenty questions on verb and article usage. Here is a typical question on the former:

1. One of these sentences contains a mistake in verb usage. Indicate the letter of the incorrect sentence:
 - a. At the moment prices increase.
 - b. Prices were increasing throughout 2009.
 - c. Recently prices have increased.
 - d. Recently prices have been increasing.

The correct answer is **a**. Using the present simple is incorrect here because the phrase "at the moment" implies a temporary process happening as we speak; the present continuous is

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needed: “At the moment prices are increasing.” The present simple, meanwhile, could be used to refer to something that increases regularly: “Consumption increases every fall.”

Regarding articles, applicants are given sentences with blank spaces and asked whether the spaces should be filled with ‘a’, ‘an’, ‘the’ or left blank. For instance:

1. Croatia will join ____ European Union.
2. Slovenia is ____ European Union member.

The first sentence requires **‘the’** since the European Union is a unique institution. The second sentence requires **‘a’** since ‘European Union’ is being used as an adjective and the article must modify the noun, ‘member’, which does not designate anything unique here (there are many members of the European Union). Meanwhile, though the word directly following the article – ‘European’ – begins with a vowel, a consonant sound is created, so ‘a’, not ‘an’, is needed.

Essay

In the essay, it is important that you answer the question given, not simply summarise the news article, and that you avoid grammar mistakes to the best of your ability.

Essay question

The article passage provides some evidence that soap operas can influence people’s behaviour in a positive fashion. Indeed, health and conflict resolution organisations have already begun creating soap operas in hopes of bringing about changes among specific

populations across the world. This has been called “edutainment” (education / entertainment). Write an essay in which you address the following questions:

What are some other problems (not mentioned in the above article) that such organisations might wish to solve and how might they do so using soap operas?

To what extent, and under what conditions, do you think such specially made “edutainment” can work?