GENERAL INFORMATION

The purpose of this file is to outline the knowledge and skills tested in the SSE Riga online Entrance Exam as well as to give general information about the online environment.

The Entrance Exam will be organized online on **Saturday, May 20, 2023**.

The Entrance Exam will involve basic math, logical aptitude and English language topics, and take about three hours in total with short breaks between the parts. Applicants should have a computer with a camera and microphone, a stable internet connection and a room where no one will disturb them during the assessment.

Note-taking and calculations on paper will be allowed in some parts and strictly forbidden in others. Selected applicants will receive all the necessary information about the exam and its procedure via email in due time / approximately one week before the Entrance Exam.

A technical set-up try-out online test will be provided to all applicants selected for the Admission Test.

Once the test will be started, clear guidance will be given.

MATHEMATICS

The purpose of this part is to outline the knowledge and skills tested in the SSE Riga Admissions Test Mathematics part.

You can watch a video "How do I prepare for the admissions test in Math?". Information is provided by Associate Professor Nicolas Gavoille who teaches Mathematics, Econometrics, Economic Specialisation and Game Theory courses at SSE Riga.

The test will take place online, so here are some indications for writing answers:
1. Use **decimal point** (0.01), not decimal comma (0,01).
2. Do **not** use thousands separators (for instance, write one thousand as "1000", not as "1,000").
3. Avoid **spaces**. For instance: write (x+y)=1 and not (x + y) = 1.

4. Use **parentheses** appropriately. For instance, (x-1)/(x+1) and x-1/x+1 are not the same.
5. Write ***** to represent **multiplication**. For example: 4*3=12.
6. To write an **exponent**, use **^**. For instance, write a^2 as a^2.
7. To write a **square root**, use **V()**. For instance, write $\sqrt{3}$ as V(3).

8. Denote ∞ and $-\infty$ respectively by "inf" and "-inf"

9. To represent **closed intervals** (when the boundaries are included in the interval), use "[" and "]". Use ";" to separate the two boundaries. For instance, x=[2;5]

10. To represent **open intervals** (when the boundaries are not included in the interval), use "(" and ")". Use ";" to separate the two boundaries. For instance, x=(1;3).

11. **To represent "x in (-∞;0) U (1;+ ∞)"**, write "x in (-inf;0) U (1;+inf)".

12. To represent a **strict inequality**, use ">" or "<".

13. To represent a **non-strict inequality**, use "<=" or "=>".

14. To denote π, write "pi".

15. If an equation has **two solutions**, write "x=1 or x=2".

1. **Find**
$$1 - 2(5 - 7)(-3) + 3$$

2. **Find**
$$\left(4 - \frac{1}{4}\right)^2$$

3. **Find**
$$\frac{1}{10}\left(\frac{1}{7} - \left(\frac{1}{3}\right)\left(\frac{1}{4}\right)\right)$$

4. **Find**
$$\frac{\frac{1}{3} - \frac{2}{5}}{\frac{1}{7} - \frac{1}{14}}$$

5. **Find**
$$(7 - \sqrt{11})(\sqrt{11} + 7)$$

6. **Find**
$$\sqrt{125} - \sqrt{20} + \sqrt{500}$$

7. **Find**
$$16^{\frac{3}{4}}$$

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8. **Simplify**

$$\frac{1}{\sqrt{3}+1}+\frac{1}{2}$$

9. **Simplify**

$$\frac{1+2\sqrt{3}}{1+\sqrt{3}}$$

10. **Simplify**

$$\frac{8^{201}+8^{202}+8^{203}}{584}$$

11. **Simplify**

$$(4x^4)^4-(x^2)^8$$

12. **Simplify**

$$\frac{1}{3}\sqrt{18}+5\sqrt{8}+0{,}6\sqrt{50}$$

13. **Simplify**

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

14. **Simplify**

$$n-\frac{n}{1-\frac{1}{n}}$$

15. **Simplify**

$$\frac{2+a}{a^2b}+\frac{1-b}{ab^2}-\frac{2b}{a^2b^2}$$

16. **Simplify**

$$\frac{\frac{1}{x-1}+\frac{1}{x^2-1}}{x-\frac{2}{x+1}}$$

17. **Factorize**

$$x^2+3x-28$$

18. **Factorize**

$$x^4-y^4$$

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19. **Simplify**

$$\frac{x^2 - y^2}{x + y}$$

20. **Simplify**

$$\frac{4x - x^3}{4 - 4x + x^2}$$

21. **Write the equation of a straight line that passes through $(-4; 4)$ and $(8; -2)$.**

22. **A line L passes through the point $(1,1)$ and has a slope of 4. A second line M passes through $(-1,2)$ and $(3,-1)$. Find their point of intersection P.**

23. **Find**

$$log_2\left(\frac{1}{16}\right)$$

24. **Solve the equation** $ln(x^2 - 1) - ln(2x - 1) + ln(2) = 0$

25. **Find**

$$log_5\left(\sqrt[3]{5^2}\right)$$

26. **Find** $ln\left(e\sqrt{e}\right) + 2ln(e^3)$

27. **Solve the equation** $e^{2x+1} = 7$

28. **Solve the equation** $e^x + 4e^{-x} = 4$

29. **Solve the equation for t**

$$\frac{1}{\sqrt{2\pi}}e^{-\frac{1}{2}t^2} = \frac{1}{8}$$

30. **Solve the equation** $log_{10}(x + 2) - log_{10}(x + 1) = log_{10}(x - 1)$

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31. **Solve the equation** $$3x = \frac{1}{4}x - 7$$

32. **Solve the equation** $$(x + 1)^2 = 10(x + 1)$$

33. **Solve the equation** $$x^2 - 3x + 2 = 0$$

34. **Factorize** $$x^2 + 2xy^2 + xy + 2y^3$$

35. **Factorize** $$x^4 - y^4$$

36. **Solve the equation** $$x^4 - 2x^2 = 3$$

37. **Factorize** $$2q^2 + 16q - 66$$

38. **Solve the equation** $$\sqrt{2x + 14} = 16$$

39. **Solve the equation** $$\sqrt{\left(25 - \sqrt{x + 2}\right)} = 4$$

40. **Solve the equation** $$4^{\sqrt{x}+1} + 4^{\sqrt{x}-1} = 42 - 4^{\sqrt{x}}$$

41. **Solve the equation** $$\frac{x + 2}{x - 2} - \frac{8}{x^2 - 2x} = \frac{2}{x}$$

42. **Solve the equation** $$3^{x-1} \cdot 4^{x+1} = 192$$

43. **Solve the inequality** $$3x + 5 < x - 13$$

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44. **Solve the inequality**

$$\frac{2x-4}{3} \le 7$$

45. **Solve the inequality**

$$81 < x^2$$

46. **Solve the inequality**

$$(x-1)^2(x+4) > 0$$

47. **Solve the inequality**

$$-\frac{1}{3}x^3 - x^2 + 6x \le 0$$

48. **Solve the inequality**

$$\frac{\frac{1}{x}-1}{\frac{1}{x}+1} \ge 1$$

49. **Solve the inequality**

$$\frac{1}{p-2} + \frac{3}{p^2-4p+4} \ge 0$$

50. **Solve the inequality**

$$(0{,}77)^{5x} > (0{,}77)^{x-1}$$

51. **Solve the system of equations**

$$\begin{cases} x + 5y = 12 \\ 4x - 3y = 2 \end{cases}$$

52. **Find two numbers whose sum is 52 and difference is 26.**

53. **Solve the system of equations**

$$\begin{cases} x^2 - y^2 = 3 \\ x - y = 1 \end{cases}$$

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54. **Solve the system of equations**

$$\begin{cases} x + y + 2z = 3 \\ x + 2y + z = 1 \\ 2x + y + z = 0 \end{cases}$$

55. **Solve the system of equations**

$$\begin{cases} \dfrac{1}{x} + \dfrac{1}{y} = \dfrac{5}{6} \\ xy = 6 \end{cases}$$

56. **Find**

$$sin\left(\frac{3\pi}{4}\right) cos\left(\frac{\pi}{4}\right)$$

57. **Solve the equation**

$$1 + sin(2x) = 0 \text{ (with } 0 \leq x \leq \pi)$$

58. **Solve the equation**

$$\frac{cos^2(x) - sin^2(x)}{cos^2(x) + sin^2(x) = 1} \text{ (with } 0 \leq x \leq 2\pi)$$

59. **Solve the equation**

$$sin(x) = \sqrt{3}cos(x) \text{ (with } 0 \leq x \leq 2\pi)$$

60. **Solve the inequality**

$$sin(x) \geq \frac{\sqrt{3}}{2} \text{ (with } 0 \leq x \leq 2\pi)$$

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LOGICAL APTITUDE

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

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.	69x70=	490	4650	5000	4800	4600
3.	905÷49=	18	14	13	15	12

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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 multiplication 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?
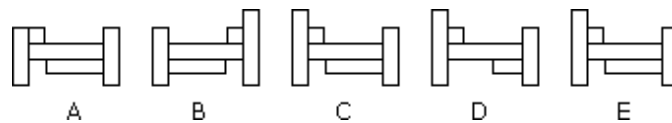
Answer
C and E are the only two pictures that are identical.

The best strategy for these types of questions 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 questions, 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.

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ENGLISH LANGUAGE

The English language part of the admissions exam is a multiple choice test that assesses the use of grammar, vocabulary, idioms and transitional expressions, and reading comprehension. Please review the sample questions below for a better idea of the format and content of exam questions.

Multiple choice grammar questions will test your ability to use verb tenses, articles, pronouns, and many other advanced grammar structures correctly, e.g.:

1. **The discovery was the first of _____ kind and produced great excitement among geneticists.**
   (a) its, (b) it's, (c) its'

In the example above, it is important to know that the apostrophe marks omissions in contracted words ("it is" turns into "it's") and forms the possessive case (the kids' toys), but it is NOT used with possessive pronouns ("its kind"); hence, the correct answer is (a).

2. **The government has promised support to struggling businesses, but has provided _____ details on how they would proceed.**
   (a) few, (b) a few, (c) the few

Here, the presence or absence of articles creates a change in meaning. If we look at the overall meaning of the sentence, the optimistic first part is followed by a transition word "but", which introduces a contrast—most likely something negative. Based on this, we can assume that "the details the government has provided" would have the negative connotation of "not enough" or "insufficient", which is the meaning achieved by "few" without an article. Thus the correct response is (a).

3. **The newspaper reported that the crime was not an isolated case and that similar incidents _____ in the area before.**
   (a) have occurred, (b) had occurred, (c) had been occurred, (d) have been occurring

The first thing you need to do here is establish time relationships between the actions described in this sentence. What you see is that there is a new crime in the more recent past, and older crimes perpetrated in the area before this more recent crime. If the story about the latest crime is told in the past tense, it means that we need to backshift to the past perfect tense to reach the older incidents that happened before it – either (b) or (c). Since the verb "occur" is intransitive and we cannot form the passive voice with it, (c) does not work, which leaves us with (b) as the only option. And in case you are wondering, (a) and (d) do not work because the present perfect can only be used when there is some connection to the present moment, which is not the case here.

4. **Too many teachers are overworked and on the verge of burnout. This has _____ a problem in many schools.**
   (a) emerged, (b) caused, (c) encountered, (d) A, B and C

The example above tests your vocabulary knowledge. The structure "verb + a problem" suggests that the verb is transitive (it must have an object), thus we can quickly eliminate "emerged", which is an intransitive verb and cannot be followed by an object. Next, we have a choice between "caused" and "encountered". Contextually, "this" stands for "this situation", and with

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that in mind, the sequence "the situation encountered a problem" is less successful and less logical that "this situation caused a problem", which reflects the cause-and-effect relationship between teacher burnout and problems in schools more accurately. "Caused" – answer (b) - is thus the correct answer.

5. **Two physicists _____ that people from the future are trying to sabotage particle acceleration experiments.**
   (a) accommodate, (b) speculate, (c) rely, (d) deviate

The example above tests your vocabulary knowledge, with a focus on prepositions. The structure "accommodate + that", where "that" introduces a clause, does not work grammatically; "accommodate" needs an object to follow it, so we can eliminate (a). "Physicists speculate that" is a contender – it works both grammatically and contextually, where it expresses uncertainty and guessing about the potential reasons for failed experiments. "Rely" needs the preposition "on" + an object, and "deviate" needs the preposition "from", neither of which are provided here, so we are back to "speculate" as the only acceptable option. The correct answer is (b).

6. **Research shows that bringing joy to others is a reliable way to improve your own well-being. _____ that doesn't come naturally to most of us.**
   (a) Furthermore, (b) Indeed, (c) However

Transitional adverbs help establish relationships between ideas. If you read Example 4 carefully, you will sense that the second sentence introduces a complication and contrasts with the information expressed in the first sentence. The right linking word here would be (c) – "however". The use of "furthermore" would ignore this contrast and treat the two sentences as two separate ideas, while "indeed" would mean that the second sentence supports what was said in the first, which is not the case.

7. **The anti-flying movement gained momentum after teenage activist Greta Thunberg's mother publicly announced she would stop flying. Various Swedish celebrities followed suit. "Followed suit" means:**
   (a) filed a lawsuit, (b) took her fashion advice, (c) copied her actions, (d) confronted government officials

It is good if you know that the idiomatic expression "follow suit" means "copy one's actions", but even if you don't, you can use contextual clues and the process of elimination to arrive at the right answer. The idea that other people would follow the example of a person who refuses to fly for environmental reasons – answer (c) - seems to be most reasonable; "filing a lawsuit", despite having the word "suit" in it, and "confronting government officials" are steps that would be incommensurate/illogical given that there was no offence whatsoever. Finally, "took her fashion advice" is just a play on words.

8. **A University of Virginia study explains why people rarely look at a problem and think to remove something as a solution; instead, they systematically default to addition—often, to their detriment, when the only right answer is to subtract. The team's findings suggest this is a fundamental reason why people struggle with overwhelming schedules or why humanity is exhausting the planet's resources, but it also applies to cooking, writing, and other things.**

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The study suggests that additive ideas come to mind quickly and easily, but subtractive ideas require more cognitive effort. Because people are often moving fast and working with the first ideas that come to mind, they end up accepting additive solutions without considering subtraction at all.

The University of Virginia study shows that…

    a) we value addition more highly than subtraction.
    b) our brain is genetically hard-wired for addition.
    c) we would consider subtractive solutions if given time to think.
    d) subtractive solutions are more effective than additive solutions.

The entrance exam will contain a few longer items to test your reading comprehension skills. First, read the paragraph in full and then explore each option carefully. The correct answer here is (c) – in the text, we read that "additive ideas come to mind quickly and easily", that "subtractive ideas require more cognitive effort", and that "people are often moving fast", from which we can deduce that we simply have no time for subtractive ideas due to our fast-paced life, but if we did have time to think, we would consider subtractive ideas as well. Nowhere in the text can we read that people assign special value to one approach over the other (a) – in fact, people seem to be quite unaware of the existence of the two solutions and "systematically default to addition". Similarly, the text does not describe the neurological or genetic underpinnings of subtraction and addition, so saying that "our brain is genetically hard-wired for addition" (b) would be an unwarranted claim. Finally, while the passage implies that subtractive solutions have their place and in the right situations can be more effective as additive ones, the passage does not claim that subtractive solutions are more effective overall (d).

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