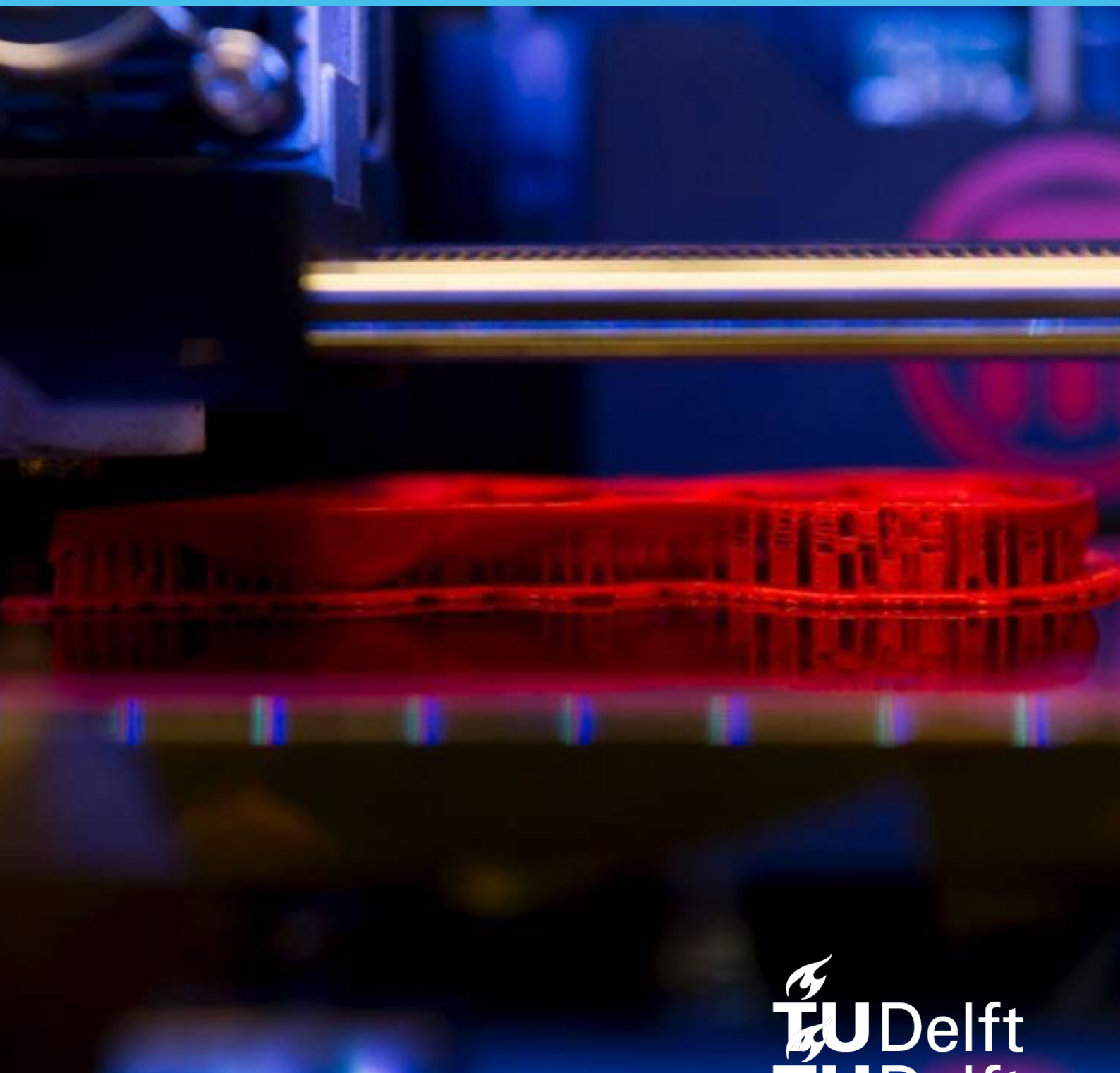
Regulation Matching & Selection Criteria and Procedure
BSc Computer Science and Engineering
Academic year 2025/2026



TU Delft

Preamble

The following Regulation Matching & Selection Criteria and Procedure for the bachelor programme Computer Science and Engineering 2025/2026 has been drawn up, in accordance with Article 3 of the TU Delft Selection and Placement Regulations, following advice from the Faculty Student Council of EEMCS.

Contents

1. General Regulations

1.1. The execution of this regulation is appointed to the Committee Selection Computer Science and Engineering, hereafter referred to as the Committee.

1.2. The Executive Board of the TU Delft has set the maximum number of students for the academic year 2025/2026 at 550, taking into account Article 9, Clause 3 of the TU Delft Selection and Placement Regulations.

1.3. The Committee will, in accordance with the GDPR, only communicate about the participation of a candidate with that particular candidate.

1.4. Candidates who have been diagnosed with a learning disability and/or are experiencing extenuating circumstances can request extra time for the Cognitive Skills Tests, by contacting selectie-esa@tudelft.nl. Requests need to be supported with official documentation (e.g. a medical or psychological statement) in English or Dutch, or including a certified translation in English or Dutch, and should be submitted between 15 January and 7 February 10:00 CET[1]. As this concerns private information, these requests will be handled by the student counsellors, who can consult the Committee if necessary. After the submission deadline the student counsellors will send their recommendations to the Committee. Candidates will be informed of the outcome by the Committee in the week after the deadline.

[1] The mandatory instructions for submitting a request for extra time on the Cognitive Skills Tests, can be found on the website in the extra time information in the FAQ, under 'Matching & Selection'.

1.5. All dates are listed as dd/mm/yyyy. Times in this regulation are in Central European Time (CET), Dutch local time.

1.6. The entire matching and selection procedure and communication about this procedure is in English. One exception is made for the CST. Candidates who applied for the CSE Bilingual (Dutch-English) track will take the CST partially in Dutch. Candidates who applied for the CSE English track will take the CST in English. Apart from answers to questions asked in Dutch in the CST, all candidates are required to answer all questions in English, as the BSc Computer Science and Engineering is either fully taught in English (English track) or mainly taught in English (Bilingual track).

2. Participating in the Matching and Selection Procedure

2.1. A candidate can only participate in the matching and selection procedure with a valid and fully *completed* registration request for the programme Computer Science and Engineering, via the Dutch national enrolment system for higher education entitled Studielink, before or on the deadline of January 15th 2025.

2.2. Candidates with a non-Dutch education diploma (≠VWO)[2], must also register in Osiris (osiaan.tudelft.nl) *and* submit a *complete* application package before or on the deadline of January 15th 2025 to enable them to participate in the matching and selection procedure.

2.3. Candidates applying for the bilingual track who are holders of a foreign diploma and who cannot demonstrate Dutch language proficiency based on the diplomas listed in 'Bijlage I. art 27, section 2c of the OER EWI 2024-2025', can request an exception from the Committee to be admitted to the Bilingual track.[3]

2.4. The candidate is responsible to ensure that the email address used in the matching and selection procedure by the candidate is equivalent to the email address used for Studielink and is accessible until the start of the 2025/2026 academic year.

2.5. The candidate is responsible for checking messages in their inbox and spam folder during the entire matching and selection procedure, and making sure their inbox is able to receive emails sent out by the selection-bsc-cse email address.

2.6. Participating in the matching and selection procedure or receiving a ranking number, does *not* automatically mean that a candidate meets the stated educational prerequisites for admission. Verifying entry requirements, such as prior education, is outside the scope of the Regulation Matching & Selection Criteria and Procedure as well as the matching and selection procedure. Information about the entry requirements can be found on the admissions pages of the TU Delft website.

[2] Candidates should have a secondary school diploma equivalent to the Dutch pre-University diploma (=VWO).

[3] A request must be substantiated with evidence that there is sufficient command of the Dutch language. You can submit your request by sending it to selection-bsc-cse@tudelft.nl. Requests need to be submitted before 23:59 CET on January 15th, 2025.

2.7. A candidate can only participate once per academic year. The results of the matching and selection procedure are only valid for that particular matching and selection procedure which selects candidates for the upcoming academic year.

2.8. After the Studielink enrolment deadline of January 15th 2025, candidates are *not* allowed to switch language track during the matching and selection procedure. Candidates have to follow the procedure intended for the track for which they have registered in Studielink.

2.9. A candidate may participate up to three times in the matching and selection procedure of the BSc programme Computer Science and Engineering, regardless of the tracks they choose. An active request for enrolment in Studielink after January 15th 2025 will count as a selection opportunity, even if a candidate does *not* participate *nor* completes the matching and selection procedure.

2.10. Candidates who have previously been enrolled in the Computer Science and Engineering programme, but who have discontinued their studies due to a negative BSA are only allowed to re-apply for this programme after 4 years. These candidates have to (re-) participate in the matching and selection procedure, before being able to be re-admitted.

3. Selection Criteria

3.1. On the basis of the end terms of the programme the following three cognitive criteria have been distilled that form the basis for the selection for the bachelor Computer Science and Engineering:

1. Mathematics
2. Systematic Reasoning & Logical Thinking
3. Problem Solving

3.2. Each element will be assessed with individual assignments or tests.

3.3. Several steps are defined to match and select candidates, some of which are *not* necessarily linked to a single selection criterion, but are part of the matching and selection procedure.

4. Matching & Selection Procedure

4.1. The matching and selection procedure consists of the following components:

1. Studying at TU Delft Questionnaire
2. Online Student Experience (OSE)
3. Cognitive Skills Test (CST)
4. Teamwork Assignment (TwA)

4.2. All components of the matching and selection procedure are mandatory and need to be completed in prescribed order, in order to proceed to the next component. The CST is graded and will determine candidates place in the ranking.

4.3. Candidates have to actively participate in all components of the matching and selection procedure, to receive a ranking number.

4.4. Those who fail to complete the steps of the matching and selection process within the stated time frames and before the deadline will be excluded from the matching and selection procedure. Candidates will not receive a ranking number and will have used a selection opportunity. Excluded candidates will be informed by e-mail within six weeks after the test period has ended.

4.5. The matching and selection procedure will take place online for all candidates. The CST will be proctored.

4.6. A single opportunity will be offered to take the CST on the TU Delft campus, not proctored. If the number of candidates exceeds the available seats for the campus CST day, seats will be randomly allocated among the candidates who choose this option.

4.7. If during the course of the Matching and Selection procedure logistic issues or health restrictions from the Dutch Government make it unfeasible to organize the CST on campus, candidates are responsible for arranging working equipment and a suitable environment to take the CST online and proctored.

4.8. Candidates who applied for the CSE Bilingual track will take the CST partially in Dutch, partially in English to confirm bilingual competence. Candidates who applied for the CSE English track will take the complete CST in English.

4.9. The CST consists of the following three elements:

1. Mathematics (40%)
2. Systematic Reasoning & Logical Thinking (35%)
3. Problem Solving (25%)

Mathematics will count for 40% of the final selection score, Systematic Reasoning & Logical Thinking will count for 35% of the final selection score and Problem Solving will count for 25% of the final selection score.

4.10. By taking the online proctored tests, candidates agree upon making and monitoring video recordings, keystrokes, and screenshots. An examiner will have access to this data to judge if the tests were completed according to the regulations. Collected data will only be used for this purpose. The collected data will be destroyed if it is clear whether the candidate is admitted or not and the objection period has ended.

4.11. The candidate is responsible for assuring a well-functioning internet connection and VPN-connection (if needed).

4.12. The candidate is responsible for testing the functionality of their equipment and the proctoring software. The candidate will be able to take a practice test on the selection platform before the CST, to test if their equipment works. All equipment problems encountered during the practice test need to be resolved by the candidate.

4.13. Candidates are required to report any issues encountered that might affect the outcome of their score within 48 hours after they have occurred and before the deadline of that respective assessment or test period.

4.14. By participating in the matching and selection procedure candidates give consent that the TU Delft is allowed to share their name and email address with the team members they are assigned to for the teamwork assignment.

4.15. Candidates are not allowed to publish or share any of the questions and/or answers of the CST or other assignments with others or on the Internet. Candidates who are caught doing so will be excluded from the matching and selection procedure and will not receive a ranking number.

5. Fraud

5.1. The candidate will need to take the selection tests under standard (Dutch) exam regulations. This means that, among other things, candidates need to verify their identity using an official photo ID, take the tests individually and without other sources of information. It is *not* allowed to communicate with others during the test by any means. When taking the selection tests online, candidates need to take the test in a quiet room; It is *not* allowed to have someone else in the room in which the test is taken nor is it allowed to have a radio or television playing in the background.

5.2. The following items are *not* allowed to be used during the tests:

a) A calculator is *not* allowed *nor* is a calculator on a mobile device;
b) Use of a second computer is *not* allowed;
c) Use of a (smart) phone is *not* allowed;
d) Use of any other mobile device than the device on which the test is taken;
e) Use of headphones or earplugs is *not* allowed.
f) Use of documentation other than the documentation permitted for the test.

5.3. The Committee will ask the candidate to cooperate in collecting evidence if a candidate is flagged with suspicious behaviour or is caught performing fraudulent behaviour. Grounds for suspecting fraud are any event or reasonable suspicion of irregularity, like: a) large-scale or organised fraud that renders the test results untrustworthy and where it is not (yet) possible to determine which individual candidates are involved; b) technical failure during the test that renders the results untrustworthy; c) extensive disruption during the test; d) the candidate fails to comply with test rules and instructions when taking or submitting the test. The suspected candidate will be interviewed and given the chance to respond in writing to the report of the Committee. During the investigation of the case, the candidate is allowed to finish the matching and selection procedure.

5.4. The Committee concludes whether rules have been violated or fraud has been committed. Candidates who have violated the rules will be penalized, with the sanction varying from being awarded zero points on the specific section of the tests to exclusion from the entire matching and selection procedure, depending on the severity of the rule violation. The decision about the rule violation and the corresponding sanction will be made by the Committee on behalf of the Dean. Candidates who have committed fraud will be penalized, with the sanction being exclusion from the entire matching and selection procedure. The decision about the fraud will be made by the Committee on behalf of the Dean.

5.5. A candidate who is excluded on the basis of fraud or rule violation, will be excluded from the matching and selection procedure of that particular year only. The candidate does *not* receive a ranking number and is considered to have used up a participation opportunity. A candidate can object to this decision[4].

6. Establishing the outcome of the matching and selection procedure and ranking

6.1. The obtained ranking number is only valid for the selection and admission procedure preceding that specific academic year. It is *not* possible to use your ranking number for later academic years if you de-register before the 1st of September, unless severe personal circumstances occur. If the latter is the case, a candidate can submit a substantiated request for an exemption to selection-bsc-cse@tudelft.nl. This request will be evaluated by the Committee.

6.2. The ranking score of a candidate is determined by the final scores, which is based on the elements as stated in Article 4.9. A separate sub-ranking is made for both tracks. The test scores of candidates of a track are compared to the final scores of the other candidates within that same track, so-called z-scores. Higher final test scores lead to a better placement in the sub-ranking of a track. The candidate with the highest final score receives the highest spot in the sub-ranking, the candidate with the second highest final score receives the next spot in the sub-ranking, et cetera.

6.3. If two or more candidates qualify for the same sub-ranking spot, the placement relative to each other will be assigned by lot.

6.4. If both tracks have an equal number of candidates, the final ranking is alternately filled with the candidates from both sub-rankings, starting with the candidate that has the highest placement in the sub-ranking and until all candidates have received a ranking number. A higher placement in the sub-ranking, will result in a better (=lower) ranking number.

[4] In accordance with the General Administrative Law Act (Algemene Bestuurswet) you may object to this decision within six weeks after the announcement to the Executive Board (CvB). You can submit your objection by sending it as a PDF attachment to CBS@tudelft.nl.

6.5. If the number of candidates in the tracks differ by more than 10%, a threshold will take effect for the sub-ranking of the smallest track.[5] All candidates with a final score below the threshold, will be transferred to the sub-ranking of the largest track, based on their absolute final scores. After the transfer is complete, the final ranking is alternately filled with candidates from both sub-rankings, starting with the candidate that has the highest placement in the sub-ranking and until all candidates have received a ranking number.

6.6. The ranking number will be ascertained by the Committee. The Committee will not correspond about the outcome. A candidate can object to their received ranking number[6].

7. Announcement of ranking number and further procedure

7.1. Candidates who have completed the matching and selection procedure will receive their final ranking number on the 15th of April 2025 through Studielink.

7.2. Candidates will receive a final standardized Z-score of their track, calculated over all three elements of the selection test (Article 4.9.), after they have received their ranking number.

No further feedback on the scores will be provided. For reasons of confidentiality and objectivity we will *not* communicate about the method and evaluation of the criteria, *nor* is it possible to review the tests or individual answers given.

7.3. When a candidate is offered a place for the bachelor programme Computer Science and Engineering, the candidate has 14 days to accept this offer in Studielink. In case this offer is *not* accepted in Studielink within that time frame, the reserved spot will be made available

for the next candidate with a ranking number who is waiting in line and has not received an offer yet.

7.4. Non-EU/non-EFTA candidates that need a visa/residence permit in order to enter the Netherlands, can only be supported in their application procedure by the Contact Centre, when they are offered a place before June 15th 2025, as it is too late to successfully complete all required steps in the registration process after this date.

7.5. In case situations occur in which this Regulation does *not* provide, the Committee will decide, on behalf of the dean, which actions and/or measures to take.

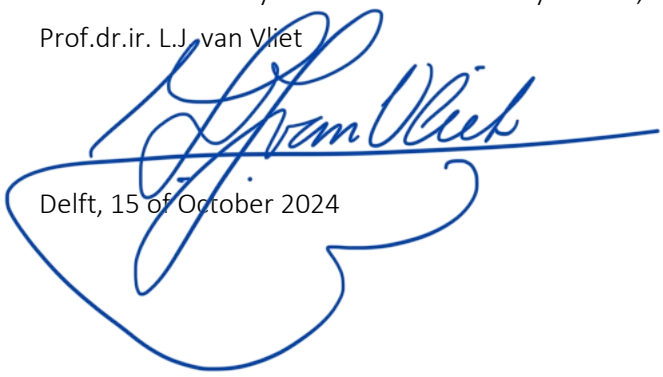
[5] The threshold will be the minimum CST score obtained by the top 80% of candidates who completed the CST in the smaller track.

[6] In accordance with the General Administrative Law Act (Algemene Bestuurswet) you may object to this decision within six weeks after the announcement to the Executive Board (CvB). You can submit your objection by sending it as a PDF attachment to CBS@tudelft.nl.

8. Final provisions

This regulation has been established by the Dean of the faculty of Electrical Engineering, Mathematics and Computer Science of the TU Delft, on 15 October 2024, and can be cited as Regulation Matching & Selection Criteria and Procedure for the bachelor program Computer Science and Engineering. This regulation applies to the Matching & Selection procedure executed in the year 2024/2025 for placement in the academic year 2025/2026 in the bachelor program Computer Science and Engineering.

Thus established by the Dean of the faculty EEMCS,
Prof.dr.ir. L.J. van Vliet



Delft, 15 of October 2024

Timeline procedure

Application and Matching & Selection BSc CSE 2025/2026

1. Application A. Apply in Studielink B. Choose your CSE language track C. Activate your TUD Net ID D. Continue in Osiris	**1st Oct - 15th Jan 23:59 CET**	**Indication of time investment**
2. Start Matching & Selection procedure Including a survey, indication of selection test (CST) preference date and Teamwork timeslot.	**21st Jan – 27th Jan 23:59 CET**	1 hour
3. Online Student Experience (OSE)	**21st Jan – 3rd Feb 23:59 CET**	1-2 hours
4. CST Preparation lecture Lecture is optional and can be followed online or on campus.	**Week of 3 February, to be announced**	2 hours
5. Confirmation CST date Receive the confirmation of your selection test (CST) date.	**Before 12th Feb**	
6. Trial Run Proctoring Test the proctoring software on the computer you will use to take the CST.	**12th Feb – 17th Feb 23:59 CET**	1 hour
7. Selection Test (CST) Complete the three parts of the CST, proctored and on your own computer or take the CST on campus.	**27th Feb or 5th March** (proctored) **8th March** (on campus)	3 hours (+ x hours preparation time)
8. Teamwork Assignment Complete the Teamwork Assignment (TwA) digitally and with your assigned team.	**11th March – 19th Mar 23:59 CET**	2 hours
9. Ranking Studielink informs student of rank#	**15th April**	
10. Accept & Finalize A. Accept your spot within 2 weeks B. Finalize registration in Studielink (and Osiaan for international students)		

TU Delft

Appendix

Syllabus 2a Mathematics Test

Below the minimum of expected knowledge for mathematics is presented. Note that the questions on the respective test might consist of a combination of multiple topics. The content in this syllabus is based on the material covered in Dutch VWO (i.e. pre-university education) schools.
The standard mathematical terms are written in **boldface**. Note that these terms might be very different in your native language. It is advised to check those terms carefully, look up the terms that you do not recognize and make a list of translations to your native language.

Mathematics

The math problems can and have to be solved exactly, i.e. without using approximation techniques or a calculator. Moreover, unless stated otherwise, this also implies that you should not round your answers (e.g. 0.33 is not considered the same as 1/3).

1. Functions and Graphs

   i The candidate is able to recognize and construct **compositions** of standard **functions**. Standard functions include.

   - **polynomial functions**,
   - ***n*-root functions** ($\sqrt[n]{x}$, $x^{\frac{1}{n}}$),
   - **power functions** (x^a, a fixed),
   - **exponential functions** (a^x, a fixed. Specifically e^x),
   - **logarithms** ($\log_a(x)$, a fixed. Specifically the **natural logarithm** $\ln(x)$),
   - **trigonometric functions** ($\sin(x)$, $\cos(x)$ and $\tan(x)$),
   - the **absolute value function** ($|x|$).

   ii The candidate is able to analyze, and transform (compositions of) these standard functions, to determine **limits**, **domain**, **range**, **asymptotes** and **symmetry**-points or -lines and to draw and recognize graphs of (compositions of) these functions.

   iii The candidate understands the concept of **inverse functions**, and can find the inverse of (compositions of) standard functions.

2. Algebraic manipulations an solving equations

   i The candidate can rewrite expressions to isolate a variable and can substitute expressions into a given function.

   ii The candidate is able to rewrite expressions into simplified form and use this skill to manipulate and solve **equations** and **inequalities** of the form $f(x) = g(x)$, $f(x) \leq g(x)$, $f(x) \geq g(x)$, $f(x) < g(x)$, $f(x) > g(x)$ and $f(x) \neq g(x)$, where f and g are (compositions of) standard functions (see 1i)

iii The candidate is able to find **roots of a function** ($f(x) = 0$) using **factorization techniques**. The candidate is able to use the **quadratic formula** to find roots of **quadratic polynomials** ($ax^2 + bx + c = 0$).

iv The candidate can solve **systems of linear equations**, $\begin{cases} ax + by = c, \\ dx + ey = f, \end{cases}$ with a, b, c, d, e, f constants.

3. Differential Calculus

i The candidate knows the **derivatives** of standard functions, and is able to apply the **sum rule**, **product rule**, **quotient rule**, and **chain rule** to determine derivatives of functions composed of standard functions.

ii The candidate is able to determine the first derivative ($f'(x), \frac{dy}{dx}, \frac{d}{dx}f(x)$) and second derivative ($f''(x), \frac{d^2y}{dx^2}, \frac{d^2}{dx^2}f(x)$) of functions and to use these to determine **locally increasing** and **locally decreasing** behavior, **extremal values**, and **inflection points**.

iii The candidate is able to apply differentiation to determine the **slope of a graph** and the local **tangent lines** and **normal lines** to the graph of a function, to construct and solve a optimization problems, and to solve problems concerning **distance**, **velocity** and **acceleration**.

4. Integral Calculus

i The candidate understands the concept of **integration** and related terms (including **limits of integration**, **definite/indefinite integrals** and the **integration constant**).

ii The candidate is able to determine **antiderivatives** (also called **primitive functions**) of standard functions, and is able to use this to calculate definite and indefinite integrals of functions of the form $cf(ax + b) + d$, with a, b, c, d constants and f a standard function.

iii The candidate is able to apply integration to determine **surface area** and **volume** of a **solid of revolution** and the **mean value** of a function.

5. Trigonometry

i The candidate understands the trigonometric functions $\sin(x)$, $\cos(x)$ and $\tan(x)$ and their relation to the **unit circle**. The candidate understands the terms **amplitude**, **phase**, **period**, and **frequency** and can relate those to the parameters in a **sinusoidal function** such as $f(t) = d + a\sin(b(t - c))$. The candidate is able to convert **degrees** to **radians** and vice-versa.

ii The candidate knows the exact values of $\sin(\theta)$, $\cos(\theta)$ and $\tan(\theta)$ for the following angles (in radians) $\theta = 0, \frac{1}{6}\pi, \frac{1}{4}\pi, \frac{1}{3}\pi$ or $\frac{1}{2}\pi$, as well as **integer** multiples of these angles.

iii The candidate knows is able to use periodicity and symmetry properties of $\sin(\theta)$, $\cos(\theta)$ and $\tan(\theta)$.

iv The candidate is able to find all solutions of equations $\sin(x) = c$, $\cos(x) = c$ and $\tan(x) = c$, and of $\sin(f(x)) = \sin(g(x))$, $\cos(f(x)) = \cos(g(x))$ and $\tan(f(x)) = \tan(g(x))$, where c is a constant and $f(x)$ and $g(x)$ are **linear functions** of x.

v The candidate is able to find all solutions of equations $\sin(x) = c$, $\cos(x) = c$ and $\tan(x) = c$, and of $\sin(f(x)) = \sin(g(x))$, $\cos(f(x)) = \cos(g(x))$ and $\tan(f(x)) = \tan(g(x))$, where c is a constant and $f(x)$ and $g(x)$ are linear functions of x.

vi The candidate is able to solve inequalities $\sin(f(x)) \leq c$, $\cos(f(x)) \leq c$ and $\tan(f(x)) \leq c$, where c is a constant and $f(x)$ and $g(x)$ are linear functions of x. The same for $\leq$ replaced with $<$, $>$ or $\geq$.

vii The candidate is able to apply the **Pythagorean identity** $\sin^2(x) + \cos^2(x) = 1$, **sum and difference identities** and **double angle formulae**.

6. Geometry

i The candidate is able to determine the **surface area** and **perimeter length** of two-dimensional shapes including **triangles**, **rectangles**, **circles**, etc. The candidate is able to determine the volume and surface area of three-dimensional objects including **cubes**, **pyramids**, **cylinders**, **cones**, etc.

ii The candidate can use properties of lines, triangles, circles, and **quadrilaterals** to determine **lengths** and **angles**. The candidate knows and can use the properties of a **right-triangle**, **isosceles triangle**, and **equilateral triangle**.

iii The candidate can use the **Pythagorean theorem**, relations between sin, cos and tan, the **law of sines** and the **law of cosines** to determine lengths and angles in triangles.

iv The candidate can formulate equations for lines and circles, and knows the relations between the slopes of normal and tangent lines.

v The candidate is able to find the **points of intersection** between lines and circles.

7. Vectors

i The candidate understands the concept of a **vector**, and can determine the **norm** (i.e. length) and **direction** of a vector.

ii The candidate can **decompose** vectors into **components**, can multiply a vector with a **scalar**, and can add and subtract vectors. The candidate can calculate the **dot product** of two vectors, and can use it for the calculation of angles and distances and to detect **orthogonality**.

iii The candidate can calculate **speed**, velocity and acceleration of a moving point whose path is described by a time-dependent vector representation.

Remark:
Vectors will be denoted boldface or with an arrow: $\mathbf{v}$ or $\vec{v}$. When expressed in components, a vector will denoted using round brackets, e.g. $\begin{pmatrix} 3 \\ -5 \end{pmatrix}$. The norm (= length) of a vector $\mathbf{v}$ will be denoted as $\|\mathbf{v}\|$.

Formula sheet: Mathematics - v2019.1

Trigonometry

Pythagorean identity

$$\cos^2(x) + \sin^2(x) = 1 \tag{1}$$

Angle sum and difference identities

$$\cos(\alpha - \beta) = \cos(\alpha)\cos(\beta) + \sin(\alpha)\sin(\beta) \tag{2}$$

$$\cos(\alpha + \beta) = \cos(\alpha)\cos(\beta) - \sin(\alpha)\sin(\beta) \tag{3}$$

$$\sin(\alpha - \beta) = \sin(\alpha)\cos(\beta) - \cos(\alpha)\sin(\beta) \tag{4}$$

$$\sin(\alpha + \beta) = \sin(\alpha)\cos(\beta) + \cos(\alpha)\sin(\beta) \tag{5}$$

$$\tan(\alpha - \beta) = \frac{\tan(\alpha) - \tan(\beta)}{1 + \tan(\alpha)\tan(\beta)} \tag{6}$$

$$\tan(\alpha + \beta) = \frac{\tan(\alpha) + \tan(\beta)}{1 - \tan(\alpha)\tan(\beta)} \tag{7}$$

Double-angle formulae

$$\cos(2x) = \cos^2(x) - \sin^2(x) \tag{8}$$

$$= 2\cos^2(x) - 1 \tag{9}$$

$$= 1 - 2\sin^2(x) \tag{10}$$

$$\sin(2x) = 2\sin(x)\cos(x) \tag{11}$$

$$\tan(2x) = \frac{2\tan(x)}{1 - \tan^2(x)} \tag{12}$$

Integrals

$$\int x^a \ \mathrm{d}x = \frac{x^{a+1}}{a+1} + C \qquad (a \neq -1) \tag{13}$$

$$\int a^x \ \mathrm{d}x = \frac{a^x}{\ln(a)} + C \qquad (a \neq 1) \tag{14}$$

$$\int \frac{1}{x} \ \mathrm{d}x = \ln|x| + C \tag{15}$$

$$\int e^x \ \mathrm{d}x = e^x + C \tag{16}$$

$$\int \ln(x) \ \mathrm{d}x = x\ln(x) - x + C \tag{17}$$

$$\int \log_a(x) \ \mathrm{d}x = \frac{1}{\ln(a)}(x\ln(x) - x) + C \qquad (a > 0 \,\text{and}\, a \neq 1) \tag{18}$$

$$\int \sin(x) \ \mathrm{d}x = -\cos(x) + C \tag{19}$$

$$\int \cos(x) \ \mathrm{d}x = \sin(x) + C \tag{20}$$