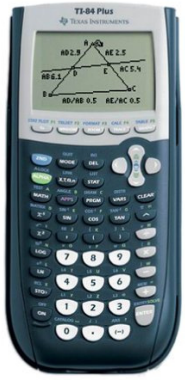
To all students starting in the IB diploma programme, 2u.

I would like to take the opportunity to welcome you to maths at Birkerød Gymnasium and IB – and to tell you about calculators, presumed knowledge and the choice of maths level.

Calculators

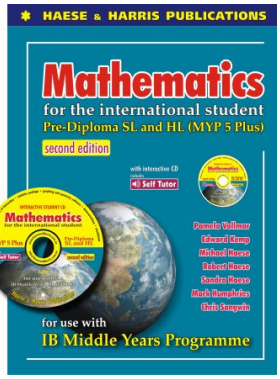


At Birkerød Gymnasium (BG), teaching and text books for maths are based on the *graphical display calculators* TI 83 and TI 84 from Texas Instruments.

We therefore ask our students to acquire either a TI 83 or a TI 84 (or one of its variants "*Plus*" or "*Silver Edition*") and bring it when school starts in August. You should bring your calculator for all maths and science classes.

Please notice that more powerful machines like TI 89 or other machines with *Computer Algebra System* (CAS) are not allowed for the diploma exams.

Presumed knowledge



Our students come from many different countries and many different school systems – hence they have very different maths background. In order for us to be able to get a smooth and quick start into the maths syllabus for the Diploma Exam, we ask you to study the enclosed list of *Presumed Knowledge for IB mathematics at BG* – and make sure you are fluent in all the topics listed.

If you want to revise maths, I can recommend the book we are using for our Pre-IB classes: *Mathematics for the international student. Pre-Diploma SL and HL (MYP 5 Plus)*, from Haese & Harris.

Which maths level?

As you may know, maths in the Diploma Programme is quite challenging, and as we want our students to be successful, we discourage them from choosing a level above their capacity. When you start in August you will therefore be tested in the presumed maths knowledge. A detailed list of presumed knowledge can be found below. Based on the result of this test you will be assigned to the appropriate level of maths, even if it is lower than the one you have indicated in your application.

Sincerely,

Niels Erik Wegge,

Head of Maths,
Birkerød Gymnasium and IB.

Presumed Knowledge for IB Mathematics at Birkerød Gymnasium 2009

Number and Algebra

1. Order of algebraic operations. *Examples*: $2(3+4\times7) = 62$; $(-3)^2 = 9$; $-3^2 = -9$
2. Fluency in use of addition, subtraction, multiplication and division using integers, decimals and fractions (both with and without calculator).
3. The number systems: natural numbers (N); integers (Z); rationals (Q) and irrationals; real numbers (R).
4. Prime numbers and factors, including greatest common factors and least common multiples.
5. Numbers in 'scientific notation': 1.22×10^5, 7.4×10^{-3}, including calculations involving them (both with and without calculator).
6. Rounding; decimal approximations and significant figures; percentage errors.
7. Absolute value (modulus): $|-5| = 5$ etc.
8. Intervals on the real number line using set notation and using inequalities. Example: $x\in[2;7[\Leftrightarrow 2 \le x < 7$
9. Square roots and surds (without a calculator):
   a. Addition, subtraction, multiplication: $\sqrt{27}+\sqrt{75} = 3\sqrt{3}+5\sqrt{3} = 8\sqrt{3}$; $\sqrt{3}\times\sqrt{5} = \sqrt{3\times5} = \sqrt{15}$; $(1+\sqrt{3})(2+\sqrt{3}) = 5+3\sqrt{3}$.
   b. Quotients: $\dfrac{8}{3+\sqrt{5}} = \dfrac{8\cdot(3-\sqrt{5})}{(3+\sqrt{5})(3-\sqrt{5})} = \dfrac{24-8\sqrt{5}}{4} = 6-2\sqrt{5}$.
10. Exponents / powers:
    a. Simple positive powers: $2^3 = 8$; $(-3)^3 = -27$; $(-2)^4 = 16$
    b. Power 0 and negative powers: $7^0 = 1$; $7^{-2} = 1/49$.
    c. Fractional powers: $121^{1/2} = \sqrt{121} = 11$; $27^{1/3} = \sqrt[3]{27} = 3$.
    d. Use index laws: $\left(\dfrac{2}{3}\right)^{-3} = \dfrac{27}{8}$, $16^{\frac{3}{2}} = 64$, $\left(5x^{-2}\right)^{-1} = \dfrac{x^2}{5}$, $x^{-3}\times x^2 = x^{-1} = \dfrac{1}{x}$
11. Percentages and exponential functions
    a. Percentage increase and decrease. *Example*: adding 7 % by multiplying by 1.07; subtracting 10 % by multiplying by 0.9.
    b. Calculating percentage change. *Example*: going from 123 to 150 is adding 22 % since (150–123)/123 = 0.22 or since 150/123 = 1.22.
    c. Undoing percentage change. *Example:* a price has gone up by 25 %. It is now 1000 kr. What was the price before? Solution: $x\times1.25 = 1000$, so $x = 1000/1.25 = 800$ (i.e. 20 % less).
    d. Successive percentage change and compound interest. *Example:* I loaned 2000 $ from the bank. After 6 years of not paying it back, I now owe 4200 $. What is the yearly interest rate on the loan?
    Solution: Amount has gone up by the factor 4200/2000 = 2.1 = 210 %. Each year it has therefore gone up by the factor $\sqrt[6]{2.1} = 1.13163$, so yearly interest rate is 13.2 % (to 3 significant figures)
    e. Exponential growth and decay (radioactive decay, population growth etc.)

Expressions and formulae

12. Basic manipulation of simple algebraic expressions involving factorisation and expansion. *Examples*: $ab+ac = a(b+c)$; $(a\pm b)^2 = a^2+b^2\pm2ab$; $a^2-b^2 = (a+b)(a-b)$; $3x^2+5x+2 = (3x+2)(x+1)$.
13. Addition and subtraction of algebraic fractions with denominators of the form $ax+b$.
    Example: $\dfrac{2x}{3x-1}+\dfrac{3x+1}{2x+4} = \dfrac{13x^2+8x-1}{(3x-1)(2x+4)}$.
14. Evaluation of formulae. *Example*: if $T = 2\pi\sqrt{L/g}$, what is the value of T for $L = 2$ and $g = 9.8$?
15. Rearrangement of formulae. *Example*: using the formula for T above, find a formula for L.

Equations and inequalities

16. Solution of equations and inequalities in one variable. *Example*: $\frac{3}{7}-\frac{2x}{5}=\frac{1}{2}(1-x) \Rightarrow x=\frac{5}{7}$.
17. Solution of simultaneous equations in two variables. *Example*: $\left.\begin{array}{l} 2x+5y=23 \\ 3x-4y=0 \end{array}\right\} \Rightarrow x=4, y=3$
18. The properties of $<, \leq, >, \geq$. *Examples*: $a>b,\ c>0 \Rightarrow ac>bc$; $a>b,\ c<0 \Rightarrow ac<bc$.
19. Quadratics
    a. Sketch the parabola from the quadratic function $f(x) = ax^2 + bx + c$ (shape, y-intercept, roots, turning point)
    b. Factorise quadratic expressions.
    Examples: $6x^2-3x=3x(2x-1)$; $5x^2-3x-2=(5x+2)(x-1)$; $16x^2-9=(4x+3)(4x-3)$.
    c. Solve quadratic equations by
        i. factorisation: $x^2+3x-28=0 \Rightarrow (x+7)(x-4)=0 \Rightarrow x=-7$ or $x=4$.
        ii. completing the square: $x^2+2x-2=0 \Rightarrow (x+1)^2=3 \Rightarrow x=-1\pm\sqrt{3}$
        iii. using the quadratic formula $x=\frac{-b\pm\sqrt{b^2-4ac}}{2a}$.
    d. Solve 'text problems' requiring the setting up of a quadratic equation and then solving the equation (rejecting any solution deemed impossible).

Geometry

20. Geometry of simple plane figures, e.g. angles and area of triangles, quadrilaterals, polygons, circles.
21. The Cartesian plane: ordered pairs (x, y) , origin, axes; mid-point of a line segment and distance between two points in the Cartesian plane.
22. The linear function $y = mx + b$: its graph, gradient (m) and y-intercept (b). *Example*: Find the equation of the line that passes through the points (4, 3) and (–2, 1).
23. Parallel and perpendicular lines, including $m_1 = m_2$, and $m_1m_2 = –1$ (where m_1 and m_2 are the gradients). *Example*: Find the equation of the line that passes through the point (4, 3) and is perpendicular to the line with equation $4x – 3y = 1$.
24. Right angled triangles:
    a. Pythagoras' theorem and its converse.
    b. sin, cos, tan.
    c. Simple applications for solving triangles.
25. Non-right angled triangles: sine and cosine rules.

Statistics and probability

26. Descriptive statistics: collection of raw data, display of data in pictorial and diagrammatic forms (for example, pie charts, pictograms, stem and leaf diagrams, bar graphs and line graphs).
27. Calculate simple statistics from discrete data, including mean, median and mode.
28. Probability:
    a. Measure probability using sample space diagrams.
    b. Independent and mutually exclusive events.
    c. Know when to multiply and when to add probabilities: the 'AND' and the 'OR' rule.
    d. Use tree diagrams to represent outcomes of compound events.

Using and Applying Maths

29. In the PreIB at BG we do a "Portfolio task". This is an open-ended task, for which the students individually set up the problem themselves and use and apply mathematics to solve it. The assignment is written in an investigational style using correct maths notation and computer technology for computation and data processing.