

where students come first!



Year 12- General Mathematics

Algebraic Modeling

A collage of various mathematical and scientific diagrams and formulas. It includes:

- Equations: $F = qv \times B$, $V_f = V_i + at$, $\left(\frac{a}{b}\right)^n = \frac{a^n}{b^n}$, $y = f(x)$, $\Delta u = d$, $\int t^n dt = \frac{t^{n+1}}{n+1} + C$, $\frac{d}{dt} \left(\frac{u}{v} \right) = \frac{v \frac{du}{dt} - u \frac{dv}{dt}}{v^2}$, $s_a = \frac{1}{6} k \left(\frac{\Delta t}{2} \right)^3 + v_0 \frac{\Delta t}{2}$, $\theta \sin u = \theta \sin' u$, $\frac{d}{dt} \left(\frac{u}{v} \right) = \frac{v \frac{du}{dt} - u \frac{dv}{dt}}{v^2}$, $\frac{d}{dt} \left(\frac{u}{v} \right) = \frac{v \frac{du}{dt} - u \frac{dv}{dt}}{v^2}$.
- Diagrams: A Bohr-style atomic model with a central nucleus and three elliptical orbits containing electrons. A circular diagram with radial lines and labels like $(am)^n$ and $a'mn'$. A flowchart with diamond-shaped decision boxes and rectangular process boxes. A chemical structure of a complex organic molecule with atoms labeled Fe, C, N, O, and ON. A chemical structure of a carboxylate group $CH_3-CH_2-C(=O)-O-CH_3$. A chemical structure of a chain of atoms labeled OFF, Fe, C, N, C, Fe.
- Other elements: A large blue 'S' shape in the top left corner of the collage area.

Algebraic modelling

Practice Questions:

1) Substitution, Indices and algebraic processes:

1. (3 marks)

Solve the equation:

$$\frac{3x-1}{5x+2} = \frac{3x-2}{5x+1}$$

2. (1 marks)

Solve: $x^3 = 5x^2$

3. (2 marks)

Simplify: $\frac{x^2+y^2+2xy}{x^2-y^2}$

4. (3 marks)

Simplify: $\frac{3}{x^2-9} - \frac{1}{x^2-6x+9}$

5. (3 marks)

Simplify: $\frac{a^2-25}{a^2-7a+10} \div \frac{a^2+6a+5}{3a^2-6a}$

6. (4 marks)

If $f = \frac{(M-m)g}{(M+m)}$, find m, if $M=32, g=10, f=5.5$

7. (3 marks)

Find T to the nearest whole integer if $L = 8/4 \left(\frac{T}{\pi}\right)^2$, when $L=3.5, g=9.8$

8. (2 marks)

Simplify: $\left(\frac{x^6}{x^3}\right)^2$

9. (2 marks)

Simplify: $(4ah^2 b^2 c^2)^2$

10. (2 marks)

Simplify: $(x+2)/3 - (2-3x)/2$

11. (2 marks)

Simplify: $(x^2+y^2+2xy)/(x^2-y^2)$

12. (2 marks)

Expand: $5a(a^2-2a) - 3a^2(2a-3)$

2) Graphing linear functions and generating tables of value:

- Find the gradient of the lines joining:
a) (1,3) and (2,1) b) (-1,4) and (-5,4) c) (-3,-6) and (2,-4)
- Write down the gradient and y-intercept for the following lines:
a) $y = 4x + 3$ b) $5x + y + 2 = 0$ c) $6x - 1 = 11 + 3y$ d) $\frac{3x+5}{y-2} = -1$
- Write down the gradient and y-intercept for the following lines:
a) $3ky - 7kx - 2y - x = -22$ b) $2k(x - y) + y(k + 1) - 1 = 0$
- Given the gradient and the y-intercept, find the equation of the line. Give it in the general form:
a) $m = -2$ y-intercept $= -\frac{1}{2}$ b) $m = 15$ y-intercept $= -11$ c)
 $m = -\frac{23}{14}$ y-intercept $= -\frac{89}{13}$
[$y = mx + b, m = \text{gradient and } b = \text{y-intercept}$]
- Sketch $y = 4x + 5$
- Sketch $y = 9x + 3$
- Sketch $2y + 3x = -2$

3) Point of intersection of two linear functions:

1. Find the point of intersection of $5x - y + 12 = 0$ and $18x - 7y - 18 = 0$:
2. Find the point of intersection of $13x - 4y - 11 = 0$ and $19x - 2y - 18 = 0$:
3. Show that the point of intersection of the lines $12x - 11y + 7 = 0$ and $9x + 13y - 18 = 0$ is not $(-5, 7)$:
4. Show that the point of intersection of the lines $13x - 15y + 33 = 0$ and $7x + 5y - 114 = 0$ is not $(-11, 9)$:

4) Graphing quadratic functions and finding min/max values:

1. Sketch $y = x^2 - 1$
2. Find the the min. value of $y=x^2 - 1$
3. Sketch $y = -x^2 + 4$
4. Find the max point of $y = -x^2 + 4$

5) Sketching other graphs:

1. Sketch $y = 2/x$
2. Sketch $y = 4x^3$
3. Sketch $y = e^{-x}$
4. Sketch $y = -e^x$
5. Sketch $y = -e^{-x}$

6) Direct/inverse variations:

1. y varies directly with x . If $y = 15$ when $x = 3$, find y when x is 1.
2. y varies inversely with x . If $y = 15$ when $x = 3$, find y when x is 1.
3. b varies directly as the square root of c . If $b = 1$ when $c = 16$, find b when c is 9.
4. b varies inversely as the square root of c . If $b = 1$ when $c = 16$, find b when c is 9.
5. z varies directly as the cube of d . If $z = 175$ when $d = 5$, find z when d is 2.
6. z varies inversely as the cube of d . If $z = 175$ when $d = 5$, find z when d is 2.
7. g is directly proportional to the square of a . If $a = -3$ when $g = -9$, find a when g is -25 .
8. g is inversely proportional to the square of a . If $a = -3$ when $g = -9$, find a when g is -25 .