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Mathematics required:
- *domain, range of graphs*
- *rates of change*
- *differentiation*
- *maximum and minimum points of graphs*
- *symmetry of graphs*
- *graphs of linear, exponential, quadratic, polynomials and rational functions*

Technology required:
- *Graphing using **Y**= screen*
- *Finding tangent lines to curves*
- *Tables of values*
- *Graph link cable*
- *Equation editor*
- *Graphmatica*

Part A:
Use the following set of test functions to compare and contrast properties of linear, exponential, quadratic, higher-degree polynomial and rational functions.
- make notes about the *tables of values* and *graphs* related to these test functions
- record your observations in a suitable chart (table)
- where appropriate, use technology to aid construction of graphs and their tables of values.

linear	exponential	quadratic	higher-degree polynomial	rational
$f(x) = 2x + 3$ $f(x) = -2x + 3$	$g(x) = 3^x$ $g(x) = (0.3)^x$	$h(x) = x^2 + 10x + 4$ $h(x) = -x^2 + 10x + 4$	$k(x) = 0.5x^3 - 6x$ $k(x) = -0.5x^3 + 6x$	$m(x) = \dfrac{8}{x}$ $m(x) = \dfrac{8}{x^2}$

The following properties should be included:
- rate of change (increasing or decreasing) or constant
- the derivative of each
- symmetry feature (symmetrical about the vertical axis; about the origin; or about a vertical line that is not the vertical axis)
- number of maximum/minimum values (none; one; two; and so on)
- domain and range
- special features (asymptotes; other features that make this family different from any others in the table).

Part B:

For the two quadratic functions of **Part A**,
- find the gradient function by first principles for $h(x) = x^2 + 10x + 4$
- use the rule of differentiation to find the derivative for $h(x) = x^2 + 10x + 4$ and $h(x) = -x^2 + 10x + 4$.
- by algebra, find the gradient of each curve at (i) the vertex; (ii) at two *x* values equally spaced either side of the vertex. Check this using the TI-92. What property of the parabola does this demonstrate?
- use the TI-92 to find the equation of the tangent at these points.
- summarise your results in a table.