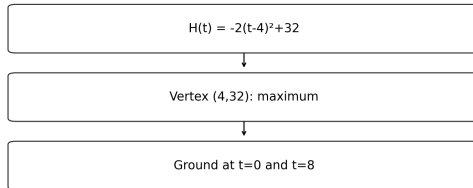


Nonlinear functions, transformations and growth

Original skill preparation; versioned source scope

Method and conditions



- Vertex form $a(x - h)^2 + k$ reveals the turning point (h, k) .
- Function notation; squares; growth multipliers.

Worked method 1

Read and reason

Vertex form $a(x - h)^2 + k$ reveals the turning point (h, k) . For $H(t) = -2(t - 4)^2 + 32$, the maximum is 32 when $t = 4$. Setting $H(t) = 0$ gives $(t - 4)^2 = 16$, hence $t = 0, 8$. Restrict time to the physical interval when the problem represents a flight.

Original context 1

Read and reason

Task context

Read and reason

Each task below states its own complete data. Values may differ from the worked example.

Attempt 1.1

Read and reason

A model height is $H(t) = -3(t - 2)^2 + 12$ metres, with t seconds from launch until return to ground. Find the domain, greatest height, and time interval with height at least 9 metres.

Reasoning 1.1

Read and reason

Ground means $H = 0$, so $(t - 2)^2 = 4$ and $t = 0, 4$. Domain is $0 \leq t \leq 4$ s. The negative square coefficient gives maximum $H(2) = 12$ m. For $H \geq 9$ m, $(t - 2)^2 \leq 1$, so $1 \leq t \leq 3$ s.

Attempt 2.1

Read and reason

A culture model starts with 120 cells and grows by a factor of 1.5 every two hours. Write $N(t)$ for hours t , find $N(4)$, and distinguish factor from percentage growth.

Reasoning 2.1

Read and reason

$N(t) = 120(1.5)^{t/2}$ cells. $N(4) = 120(1.5)^2 = 270$ cells. The growth is 50% per two hours, not 150%; the four-hour factor is 2.25. The hourly factor would be $\sqrt{1.5}$.

Attempt 3.1

Read and reason

If $f(x) = (x + 1)^2$, find the vertex of $g(x) = -2f(x - 3) + 5$ and its maximum or minimum.

Reasoning 3.1

Read and reason

Substitute the input before interpreting signs. $g(x) = -2(x - 2)^2 + 5$ has vertex $(2, 5)$ and maximum 5. The old vertex at -1 moved three units right to 2.

Transfer and limits

Read and reason

Function notation; squares; growth multipliers.

Check yourself

Read and reason

Close the worked reasoning. Explain why the method fits the final transfer task, reconstruct its conclusion, and state a condition that would change your answer. Then check the full reasoning in the reference.