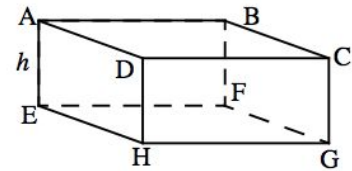


1. **(GT3.2; CA)** A rectangular box is constructed as shown, with measurements $HG = 10\text{cm}$, $\angle FHE = 30^\circ$, $\angle CEG = 15^\circ$. Find the height of the box. **(Cirrito 9.6, p.307)**



2. **(NA1.5; CI)** If $\log_3 x = K$, write each of the following in terms of K .

(Cirrito 7.4, p.221)

a. $\log_3 \left(\frac{x^5}{81} \right)$

b. $\log_3 \sqrt[4]{9x^8}$

c. $4^{\log_2 5}$

3. **(SP4.6, SP4.7; CI)** As a result of a certain random experiment, the events A and/or B may occur. These events are **independent** and $P(A) = 0.5$ and $P(B) = 0.2$.

(Cirrito 15.2, p.508; Oxford 3.2, p.68)

- Find the probability that both A and B occur.
- Find the probability that either A or B occurs.
- Find the probability that neither A nor B occurs.
- Visualize these probabilities using a Venn Diagram and a tree diagram.
- Find the probability that A happens, given that B has occurred. What do you notice?
- Find the probability that B happens, given that A has occurred. What do you notice?
- Let X denote the random variable which counts how many of the two events occur at a given time. Thus, for example, $X = 0$ if neither A nor B occur
 - What would $X = 1$ mean?
 - Find $P(X = x)$ for $x = 0, 1, 2$.
 - Tabulate your results from ii.

x	0	1	2
$P(X = x)$			

4. **(NA1.7, F2.9; CI)** Consider the system of equations $(5^x)(25^{2y}) = 1$, and $(3^{5x})(9^y) = \frac{1}{9}$.

(Cirrito 7.1.2, p.200)

- Show that this system of equations **implies** that $x + 4y = 0$ and $5x + 2y = -2$.
- Hence, solve the system of equations.

5. **(GT3.3; CI)** During the summer months, a reservoir supplies water to a city based upon the water demand modelled by the function $D(t) = 120 + 60 \sin\left(\frac{\pi}{90}t\right)$, $0 \leq t \leq 90$, where t measures the number of days from the start of summer, which lasts for 90 days.

(Cirrito 10.5, p.361)

- Sketch the graph of $D(t)$.
- What are the maximum and minimum demands made by the community over this period?
- Evaluate and interpret $D(30)$.

However, the weather next summer will be significantly different than this year, so Mayor Santowski has modified the new water demand function to now be $N(t) = 1.5D(t) + 20$.

- Explain what this new function means and how it impacts your answers for the maximum and minimum demands for the next year.

6. **(F2.5, F2.9; CI)** Given the function $f(x) = \log_3(x)$ for $x > 0$.

(Cirrito 5.3.4, Cirrito 6.1, 6.2; p.131,167,177)

- State the domain, range, asymptote(s) and intercepts for f and sketch this function.
- (CA)** Find the equation of the line that is tangent to $f(x)$ at $x = 5$. What is the significance of the slope of the tangent line?
- Let $h(x) = 9 - x$. Determine the equations for $(f \circ h)(x)$ and $(h \circ f)(x)$ and sketch both composite functions. Explain how the new functions relate to transformations of $f(x)$.
- Let $k(x) = 9x$. Determine the equations for $(f \circ k)(x)$ and $(k \circ f)(x)$ and sketch both composite functions. Explain how the new functions relate to transformations of $f(x)$.

7. **(NA1.7; CI)** Simplify the following, leaving your final answer using only positive exponents.

(Cirrito 7.1, p.197)

- $\frac{(-2)^3 \times 2^{-3}}{(x^{-1})^2 \times x^3}$
- $\frac{(-a)^3 \times a^{-4}}{(b^{-2})^{-2} b^{-5}}$
- $\frac{(x-1)^{-3}}{(x+1)^{-1}(x^2-1)^2}$
- $\frac{y(x^2)^{-1} + x^{-1}}{x+y}$

8. **(NA1.9; CI)** Expand the following binomial expressions:

(Cirrito 4.1, p.95)

- $(p+q)^6$
- $(x-2y)^6$
- $(x^2-2y)^7$
- $(2w + \frac{1}{w})^7$