

**WORKSHEET**

## Logarithmic functions extension

- 1 The magnitude of brightness of two stars can be compared with the logarithmic equation  $m_1 - m_2 = -2.5 \log_{10} \left( \frac{I_1}{I_2} \right)$ , where  $m$  is the apparent brightness and  $I$  is the intensity of brightness of the star in watts/m<sup>2</sup>.
- Explain what constitutes a brighter object: a more negative or more positive apparent brightness.
  - The maximum magnitude of brightness of a full moon as viewed from Earth is  $-12.90$ , where as the apparent brightness of a new moon is  $-2.50$ . How much more intense is the light from a full moon than a new moon?
- 2 Chris and Taylor are siblings saving for a house deposit. They want to ensure that they each contribute \$25 000. If Chris has \$10 000 to invest at 4.6% compounding monthly and Taylor has \$15 000 to invest at the same rate, how much sooner does Taylor have the deposit than Chris?

Note: The future value ( $FV$ ) of an investment can be modelled as  $FV = PV \left( 1 + \frac{r}{n} \right)^{nt}$ , where  $PV$  is the initial amount deposited,  $r$  is the annual interest rate (in decimal form),  $n$  is the number of times compounded per year and  $t$  is the time (in years) the investment is in the bank.

- 3 The sound intensity level (SIL) measured in decibels (dB) is a measurement of sound relative to the threshold of hearing (silence):

$$SIL = 10 \log_{10} \left( \frac{I}{I_0} \right)$$

where  $I$  is the intensity of sound in W/m<sup>2</sup> and  $I_0$  is the threshold of hearing  $10^{-12}$  W/m<sup>2</sup>.

How many decibels louder is the take-off of a jet ( $I = 1000$ W/m<sup>2</sup>) than a chainsaw ( $I = 0.1$ W/ m<sup>2</sup>)?

**Answers**

- 1 **a** A more negative number                      **b** 14 454 times more intense.
- 2 8.83 years.
- 3 40 dB