

- 2** A breeding program to ensure the survival of pygmy possums is established with an initial population of 50 (25 pairs). From a previous program, the expected population P in n years' time is given by $P(n) = P_0 \times (1.23)^n$.
- What is the value of P_0 ?
 - What is the expected population after:
 - 2 years
 - 5 years
 - 10 years?
 - Sketch the graph of the population over time using **a** and **b** only.
 - Hence estimate the time needed for the population to reach 500.

- 3** A flu virus spreads in a school. The number of people N infected after t days is given by $N = 4 \times 1.332^t$, $t \geq 0$.
- Find the number of people who were initially infected.
 - Calculate the number of people who were infected after 16 days.
 - There are 1200 people in the school. Estimate the time it will take for everybody in the school to catch the flu.

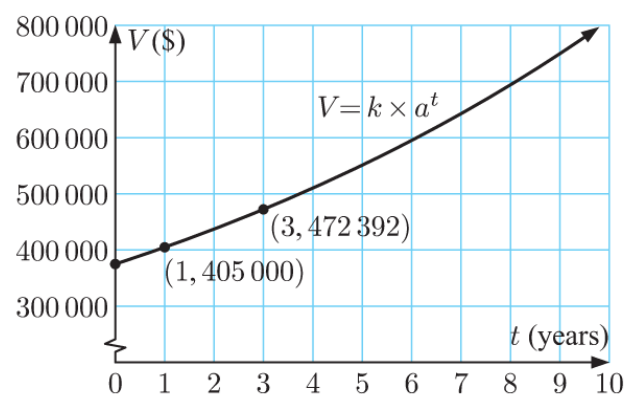
- 4** In 1998, 200 bears were introduced to a large island off Alaska where previously there were no bears. The population increased exponentially according to $B(t) = B_0 \times a^t$, where $a > 0$ is a constant and t is the time in years since the introduction.

- Find B_0 .
- In 2000 there were 242 bears. Find a , and interpret your answer.
- Find the expected bear population in 2018.
- Find the expected percentage increase in population from 2008 to 2018.
- How long will it take for the population to reach 2000?



- 7** The expected value of a house in t years' time is given by the exponential function $V = k \times a^t$ dollars, where $t \geq 0$. The function is graphed alongside.

- Find a and k , and interpret these values.
- How long will it take for the house's value to reach \$550 000?



- 8 A parachutist jumps from the basket of a stationary hot air balloon. His speed of descent is given by $V = c - 60 \times 2^{kt} \text{ ms}^{-1}$ where c and k are constants, and t is the time in seconds.



- Explain why $c = 60$.
 - After 5 seconds, the parachutist has speed 30 ms^{-1} . Find k .
 - Find the speed of the parachutist after 12 seconds.
 - Sketch the graph of V against t .
 - Describe how the speed of the parachutist varies over time.
- 9 The number of microorganisms in a culture doubles every 6 hours. How long will it take for the number of microorganisms to increase by 30%?

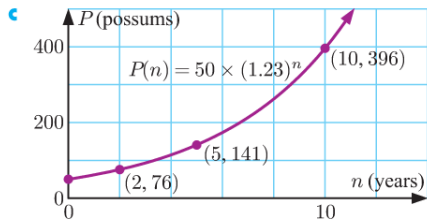
- 4 An initial count of orangutans in a forest found that the forest contained 400 orangutans. Since then, the destruction of their habitat has caused the population to fall by 8% each year.



- Write a formula for the population P of orangutans t years after the initial count.
 - Find the population of orangutans after:
 - 1 year
 - 5 years.
 - Sketch the graph of the population over time.
 - How long will it take for the population to fall to 200?
- 6 The value of a car after t years is $V = 24\,000 \times r^t$ dollars, $t \geq 0$.
- Write down the value of the car when it was first purchased.
 - The value of the car after 2 years was \$17 340. Find the value of r .
 - How long will it take for the value of the car to reduce to \$8000? Give your answer to the nearest year.
- 7 The interior of a freezer has temperature -10°C . When a packet of peas is placed in the freezer, its temperature after t minutes is given by $T(t) = -10 + 32 \times 2^{-0.2t} \text{ }^\circ\text{C}$.
- What was the temperature of the packet of peas:
 - when placed in the freezer
 - after 5 minutes
 - after 10 minutes?
 - Sketch the graph of $T(t)$.
 - How long does it take for the temperature of the packet of peas to fall to 0°C ?
 - Will the temperature of the packet of peas ever reach -10°C ? Explain your answer.

2 a $P_0 = 50$

- b i ≈ 76 possums ii ≈ 141 possums
 iii ≈ 396 possums



d ≈ 11 years e ≈ 11.1 years

3 a 4 people b ≈ 393 people c ≈ 19.9 days

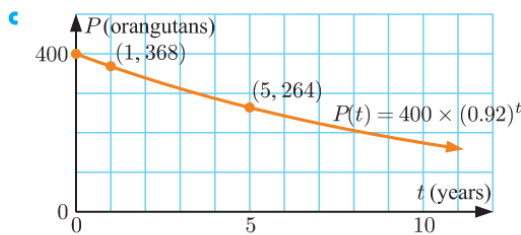
4 a $B_0 = 200$

b $a = 1.1$, the bear population is increasing by 10% every year.

c ≈ 1350 bears d $\approx 159\%$ increase e ≈ 24.2 years

4 a $P(t) = 400 \times (0.92)^t$

- b i 368 orangutans ii ≈ 264 orangutans



d ≈ 8.31 years, or ≈ 8 years 114 days

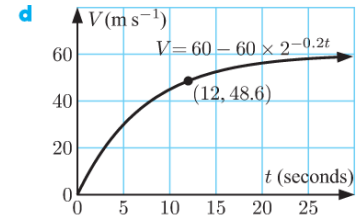
7 a $a = 1.08$, the expected value of the house is increasing by 8% per year.

$k = 375\,000$, the original value of the house was \$375 000.

b ≈ 4.98 years

8 a When $t = 0$, $V = c - 60 = 0$ b $k = -\frac{1}{5} = -0.2$
 $\therefore c = 60$

c $\approx 48.6 \text{ m s}^{-1}$

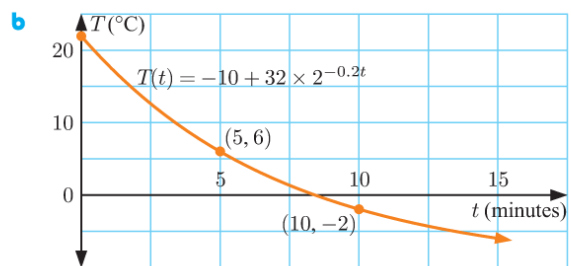


e The parachutist accelerates rapidly until he approaches his terminal velocity of 60 m s^{-1} .

9 ≈ 2.27 hours

6 a \$24 000 b $r = 0.85$ c 7 years

7 a i 22°C ii 6°C iii -2°C



c ≈ 8.39 min or ≈ 8 min 23 s

d No, as $32 \times 2^{-0.2t} > 0$ for any value of t .