2.6 Exercises

A

1. Solve for x, to two decimal places.
   (a) $x^2 = 36$ **(b)** $x^4 = 54$ **(c)** $x^3 = 78$
   (d) $x^5 = 105$ **(e)** $x^6 = 340$ **(f)** $x^7 = 210$

2. Solve for x, to two decimal places.
   (a) $3^x = 18$ **(b)** $4^x = 36$ **(c)** $5^x = 164$
   (d) $(0.9)^x = 0.714$ **(e)** $(1.02)^x = 2$ **(f)** $2^x = 10.5$

3. Solve for x, to two decimal places.
   (a) $5^x = 55$ **(b)** $x^{-\frac{3}{4}} = 8$ **(c)** $8^x = 32^5$
   (d) $4^x = \frac{1}{8}$ **(e)** $x^{-\frac{2}{3}} = 9$ **(f)** $3^{2x} = 5$

4. Find the roots of each equation, to two decimal places.
   (a) $10^{x-4} = 7$ **(b)** $8^{2x} = 79$ **(c)** $5^{2x+3} = 130$
   (d) $(2x)^4 = 18$ **(e)** $10^{2x-3} = 1500$ **(f)** $-6^{4x-5} = -20$

5. Harry invested \$500 at 8.5%/a, compounded annually. This investment is now worth \$5000. For how long has the money been invested?

6. Solve for x, to one decimal place.
   (a) $300(2)^x = 1200$ **(b)** $150(1.07)^x = 250$ **(c)** $4200(0.8)^x = 3000$
   (d) $50(2)^{\frac{x}{5}} = 350$ **(e)** $25 = 128(10)^{-0.016x}$ **(f)** $12(9)^{\frac{3x}{2}} = 840$

B

7. **Knowledge and Understanding:** The half-life of radium-226 is 1620 years. After how many years is only 30 mg left if the mass of the original sample was 150 mg?

8. After 15 days, 90% of a radioactive material has decayed. What is the half-life of the material?

9. A sum of money is invested at 7%/a, compounded semiannually. How long will it take for the money to double in value?

10. There are initially 200 bacteria in a culture. After five minutes, the population has grown to 4080 bacteria. Estimate the doubling period.

11. While Jamie was watching the games channel on television, he saw a show called "The \$64 000 Pyramid." A contestant wins \$125 for answering the first question correctly. Each additional question must be answered correctly to double the winnings. How many questions must be answered correctly to claim the grand prize of \$64 000?

12. An investment of \$4950 earns 11%/a, compounded semiannually. How long will it take for the investment to grow to \$9411?

13. **Communication:** Describe three different techniques for solving $5^x = 90$.

14. Marisa drops a small rubber ball from a height of 6 m onto a hard surface. After each bounce, the ball rebounds to 60% of the maximum height of the previous bounce.
    (a) Create a table to show the height of the ball after each bounce for the first five bounces.
    (b) Graph the relation.
    (c) Create an equation to model the height of the ball as it bounces.
    (d) Estimate the height after 12 bounces from your graph. Verify this result using your equation.
    (e) Use your graph to estimate when the ball's maximum height will be 20 cm. Verify this result using your equation.

15. The McKinney family has a pond in their yard, and water lilies are growing in the pond. The area of the lilies' leaves cover twice as much of the pond as they did 35 days ago. The leaves will completely cover the pond in 80 days if the lilies continue to grow unchecked. The McKinneys want to cut back the lilies when they have covered at most half the area of pond. When is this growth expected to happen?

16. **Application:** A plastic sun visor allows light to pass through but reduces the light's intensity. The light intensity is reduced by 5% if the plastic is 1 mm thick. Each additional millimetre of thickness reduces the light intensity by another 5%.
    (a) Create a table showing the light intensity, as a percent, and the thickness of the plastic.
    (b) Model the relation between the thickness of the plastic and the light intensity using an equation.
    (c) How thick is a piece of plastic that allows only 60% of the original light intensity to pass through?

17. **Check Your Understanding:** What key law of logarithms helps you solve exponential equations?

C 18. **Thinking, Inquiry, Problem Solving:** An adult nonsmoker has a cup of coffee at 8:00 A.M., another coffee at 11:00 A.M., a cola for lunch at 12:30 P.M., a hot chocolate at 4:00 P.M., and a cup of tea after dinner at 6:00 P.M.
    (a) How much caffeine will be in this adult's bloodstream at 11:00 p.m., when he is trying to fall asleep?
    (b) At what time will the amount of caffeine in his bloodstream be 5 mg?

19. Solve for x, to two decimal places.
    (a) $6^{3x} = 4^{2x-3}$ **(b)** $(1.2)^x = (2.8)^{x+4}$ **(c)** $3(2)^x = 4^{x+1}$

20. Determine the point of intersection between the graphs of $y = 5(4)^{2x}$ and $y = 4(2)^{6x}$. Round your answer to three decimal places.