

1.3 Solving Exponential Equations

McGraw-Hill Ryerson: MATHEMATICS 11, pp. 19-26

- If $a^x = a^y$, then $x = y$, provided $a \neq 1, 0, -1$.
- To solve an exponential equation, express both sides as powers of the same base. Then, equate the exponents.
- If both sides of the equation have a common factor, divide to remove it.

1. Solve.

- a) $5^x = 3125$ b) $7^y = 343$
 c) $1024 = 2^x$ d) $(-2)^x = -128$
 e) $-2^y = -32$ f) $2^{2x-5} = 1$

2. Solve and check.

- a) $2^{-y} = 256$ b) $6^{3x+1} = 1$
 c) $27^x = 9^{2x-1}$ d) $4^{3y-2} = 64$
 e) $2^{-4x} = 32$ f) $5^{2x-3} + 1 = 2$
 g) $8^{3x-2} = 16^{x+1}$

3. Solve.

- a) $2(3^{x-2}) = 54$ b) $4^{y-2} + 1 = 9$
 c) $2(5^{x-3}) = 50$ d) $5(4^{3y-5}) = 40$
 e) $63(3^{4-3x}) = 7$

4. Solve.

- a) $5^{x+2} - 5^x = 24$
 b) $2^{p+3} + 2^p = 18$
 c) $2^{x-1} - 2^x = -2^{-3}$
 d) $36 = 3^{x+5} + 3^{x+4}$

5. Solve and check.

- a) $\frac{8^{2x}}{4^{x-1}} = 2^{x+1}$ b) $8^{2x}(4^{2x}) = 2^{x+1}$
 c) $\frac{(9^{2x-1})(3^{3x})^2}{(27^{x+2})^3} = 81^3$ d) $8^{\frac{1}{4}} \times \left(\frac{1}{4}\right)^{\frac{x}{2}} = 16^{\frac{3}{4}}$

6. Solve.

- a) $5^{x^2-5x} = 5^{4-2x}$
 b) $3^{x^2+5} = 3^{20-2x}$
 c) $2^{3x^2+4x} = 2^{2x^2+x-2}$

7. **Radiology** Cobalt-60, which has a half-life of 5.3 years, is used extensively in medical radiology. The amount left at any given time is given by the equation

$$C = A_0 \left(\frac{1}{2}\right)^{\frac{t}{5.3}}$$

where A_0 is the initial amount and t is the time in years.

- a) What fraction of the initial amount will be left after 10.6 years?
 b) How long will it take until there is only 6.25% of the original amount left?

8. **Biology** The number of bacteria in a laboratory culture is modelled by the equation $B = 625(2)^{\frac{t}{40}}$, where B is the number of bacteria and t is the time in hours.

- a) How many hours will it take for there to be 5000 bacteria in the culture?
 b) How many hours will it take for there to be 20 000 bacteria in the culture?

7 (D)	7 (P)	8 (P)	9 (P)	10 (P)	11 (P)	12 (P)	13 (P)	14 (P)	15 (P)	16 (P)	17 (P)	18 (P)	19 (P)	20 (P)	21 (P)	22 (P)	23 (P)	24 (P)	25 (P)	26 (P)	27 (P)	28 (P)	29 (P)	30 (P)	31 (P)	32 (P)	33 (P)	34 (P)	35 (P)	36 (P)	37 (P)	38 (P)	39 (P)	40 (P)	41 (P)	42 (P)	43 (P)	44 (P)	45 (P)	46 (P)	47 (P)	48 (P)	49 (P)	50 (P)
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