

# Unit 1 Review

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$$1a) 5^{-2} = \frac{1}{25} \quad b) 6^0 = 1 \quad c) 3^{-3} = \frac{1}{3^3} = \frac{1}{27} \quad d) (-3)^{-4} = \frac{1}{(-3)^4} = \frac{1}{81} \quad e) (5^{-1}) = \frac{1}{5} \quad f) \frac{1}{(-3)^{-1}} = (-3)^1 = -3 \quad g) \frac{2^3}{2^0 - 2^{-1}} = \frac{2^3}{1 - \frac{1}{2}} = \frac{8}{\frac{1}{2}} = 8 \times \frac{2}{1} = 16$$

$$h) \frac{4^{-1} + 2^{-2}}{2^{-3}} = \frac{\frac{1}{4} + \frac{1}{4}}{\frac{1}{8}} = \frac{\frac{1}{2}}{\frac{1}{8}} = \frac{1}{2} \div \frac{1}{8} = \frac{1}{2} \times \frac{8}{1} = 4$$

$$i) \frac{a^0 + 3^2}{2^4 - b^0} = \frac{1 + 9}{16 - 1} = \frac{10}{15} = \frac{2}{3}$$

$$2 a) m^2 \times m^5 = m^7 \quad b) y^{-3} \times y^{-2} = y^{-5} = \frac{1}{y^5} \quad c) t^7 \div t^4 = t^3 \quad d) m^{-7} \div m^{-2} = m^{-7 - (-2)} = m^{-5} = \frac{1}{m^5} \quad e) (x^2 y^3)^4 = x^8 y^{12}$$

$$f) (y^3)^0 = 1 \quad g) (x^{-2} y^3)^{-2} = x^4 y^{-6} = \frac{x^4}{y^6} \quad h) \left(\frac{m^3}{n^2}\right)^4 = \frac{m^{12}}{n^8} \quad i) \left(\frac{x^{-3}}{y^{-2}}\right)^{-2} = \frac{x^6}{y^4}$$

$$3 a) (-2x^2 y^3)(-5x^3 y^4) = 10x^5 y^7 \quad b) (-18a^3 b^2) \div (-2a^2 b) = 9ab \quad c) 3m^{-2} \times 4m^6 = 12m^4$$

3d)  $(10x^{-2}) \div (-2x^{-3})$  e)  $(-2a^5b^3)^2$  f)  $(-3m^{-3}n^{-1})^{-3}$

$$= 5x^{-2+3} = 5x$$

$$= 4a^{10}b^6$$

$$= (-3)^{-3} m^9 n^3$$

$$= \frac{1}{(-3)^3} m^9 n^3$$

$$= \frac{m^9 n^3}{-27}$$

g)  $\left(\frac{3m^2}{2n^3}\right)^3$

$$= \frac{27m^6}{8n^9}$$

h)  $\left(\frac{-2x^{-3}}{3y^{-4}}\right)^{-2}$

$$= \left(\frac{-3y^{-4}}{2x^{-3}}\right)^2$$

$$= \frac{(-3)^2 y^{-8}}{2^2 x^{-6}}$$

$$= \frac{9x^6}{4y^8}$$

i)  $\frac{(3x^3y)(6xy^4)}{-9xy^2}$

$$= \frac{18x^4y^5}{-9xy^2}$$

$$= -2x^3y^3$$

j)  $\frac{3ab^4}{2a^3b^2} \times \frac{12a^5b}{15a^4b}$

$$= \frac{6a^6b^5}{5a^7b^3}$$

$$= \frac{6b^2}{5a}$$

k)  $\frac{(-2s^{-2}t)(5s^{-3}t^2)}{4s^2t^{-3}}$

$$= \frac{-10s^{-5}t^3}{4s^2t^{-3}}$$

$$= \frac{-5t^3t^3}{2s^5s^2}$$

$$= \frac{-5t^6}{2s^7}$$

l)  $\left(\frac{6a^{-2}b^{-3}}{2a^2b^{-1}}\right)^{-2}$

$$= \left(\frac{3a^{-4}b^{-2}}{1}\right)^{-2}$$

$$= \frac{a^8b^4}{3^2}$$

$$= \frac{a^8b^4}{9}$$

4a)  $6^{\frac{1}{2}} = \sqrt{6}$  b)  $5^{-\frac{1}{2}} = \frac{1}{\sqrt{5}}$  c)  $7^{\frac{3}{5}} = \sqrt[5]{7^3}$  or  $(\sqrt[5]{7})^3$  d)  $10^{-\frac{4}{3}} = \frac{1}{(\sqrt[3]{10})^4}$  or  $\frac{1}{\sqrt[3]{10^4}}$

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$$5a) \sqrt[3]{-8}$$

$$= (-8)^{1/3}$$

$$= -2$$

$$b) (\sqrt[5]{m})^5$$

$$= m^{5/3}$$

$$c) \sqrt[3]{x^2}$$

$$= x^{2/3}$$

$$d) \sqrt[5]{4a^4}$$

$$= ((4a^4)^{1/5})^{1/2}$$

$$= (4a^4)^{1/10}$$

$$\textcircled{\text{OR}} (\sqrt[4]{a^4})^{1/5}$$

$$= (a^2)^{1/5}$$

$$= \sqrt[5]{a^2}$$

$$6a) 25^{1/2}$$

$$= \sqrt{25}$$

$$= 5$$

$$b) \left(\frac{1}{27}\right)^{1/3}$$

$$\sqrt[3]{\frac{1}{27}}$$

$$= \frac{1}{3}$$

$$c) 49^{-1/2}$$

$$= \frac{1}{\sqrt{49}}$$

$$= \frac{1}{7}$$

$$d) 1^{-1/4}$$

$$= 1$$

$$e) 0.09^{0.5}$$

$$= \sqrt{0.09}$$

$$= \sqrt{\frac{9}{100}}$$

$$= \frac{3}{10}$$

$$f) (-8)^{-1/3}$$

$$= \frac{1}{\sqrt[3]{-8}}$$

$$= -\frac{1}{2}$$

$$g) (0.008)^{-1/3}$$

$$= \left(\frac{8}{1000}\right)^{-1}$$

$$= \frac{\sqrt[3]{1000}}{\sqrt[3]{8}}$$

$$= \frac{10}{2}$$

$$= 5$$

$$h) 27^{2/3}$$

$$= (\sqrt[3]{27})^2$$

$$= 3^2$$

$$= 9$$

$$\text{OR } 0.3$$

$$i) -16^{-3/4}$$

$$= -\frac{1}{(\sqrt[4]{16})^3}$$

$$= -\frac{1}{2^3}$$

$$= -\frac{1}{8}$$

$$j) \left(\frac{81}{16}\right)^{5/4}$$

$$= \frac{(\sqrt[4]{81})^5}{(\sqrt[4]{16})^5}$$

$$= \frac{3^5}{2^5}$$

$$= \frac{243}{32}$$

$$= \frac{243}{32}$$

$$k) \left(\frac{1}{9}\right)^{2.5}$$

$$= \left(\frac{1}{9}\right)^{5/2}$$

$$= \frac{1}{(\sqrt{9})^5}$$

$$= \frac{1}{3^5}$$

$$= \frac{1}{243}$$

$$l) \left(\frac{27}{125}\right)^{-2/3}$$

$$= \left(\sqrt[3]{\frac{125}{27}}\right)^2$$

$$= \left(\frac{5}{3}\right)^2$$

$$= \frac{25}{9}$$

$$m) (-32)^{4/5}$$

$$= (\sqrt[5]{-32})^4$$

$$= (-2)^4$$

$$= 16$$

6 n)  $(-8^{-1})^{-1/3}$

$$\begin{aligned} &= \left(-\frac{1}{8}\right)^{-1/3} \\ &= (-8)^{1/3} \\ &= \sqrt[3]{-8} \\ &= -2. \end{aligned}$$

d)  $\sqrt{16}$

$$\begin{aligned} &= \sqrt{4} \quad \text{OR} \quad (16^{1/2})^{1/2} \\ &= 2. \quad = 16^{1/4} \\ &= \sqrt[4]{16} \\ &= 2. \end{aligned}$$

7 a)  $\sqrt[3]{y^4}$

$$\begin{aligned} &= (y^{4/3})^{1/2} \\ &= y^{2/3} \end{aligned}$$

b)  $\sqrt{81m^8}$

$$\begin{aligned} &= (81m^8)^{1/2} \\ &= (81m^8)^{1/4} \\ &= \sqrt[4]{81} m^2 \\ &= 3m^2 \end{aligned}$$

c)  $\sqrt[3]{8x}$

$$= -2x^{1/3}$$

d)  $(\sqrt{x^3})(\sqrt{x})$

$$\begin{aligned} &= x^{3/2} x^{1/2} \\ &= x^2 \\ &= x^2 \end{aligned}$$

e)  $(\sqrt[3]{-64})x$

$$= -4x$$

f)  $\sqrt[3]{64x}$

$$= -4x^{1/3}$$

8)  $v = \left(\frac{5}{2}\right)^{-2/3}$

$$\begin{aligned} &= \left(\frac{2}{5}\right)^{2/3} \\ v &= v^3 \\ &= \left[\left(\frac{2}{5}\right)^{2/3}\right]^3 \\ &= \left(\frac{2}{5}\right)^2 \\ &= \frac{4}{25} \text{ units}^3 \end{aligned}$$

9 a)  $2^x = 64$

$$\begin{aligned} 2^x &= 2^4 \\ x &= 4 \end{aligned}$$

check

$$\begin{array}{l} \text{LS} \quad \text{RS} \\ 2^4 \quad \sqrt{64} \\ = 64 \quad \checkmark \end{array}$$

c)  $2^{x+3} = 128$

$$\begin{aligned} 2^{x+3} &= 2^7 \\ x+3 &= 7 \\ x &= 4 \end{aligned}$$

check

$$\begin{array}{l} \text{LS} \quad \text{RS} \\ 2^{4+3} \quad \sqrt{128} \\ = 2^7 \quad -128 \quad \checkmark \end{array}$$

b)  $(-5)^x = -125$

$$\begin{aligned} (-5)^x &= (-5)^3 \\ x &= 3 \end{aligned}$$

check

$$\begin{array}{l} \text{LS} \quad \text{RS} \\ (-5)^3 \quad \sqrt{-125} \\ = -125 \end{array}$$

d)  $\frac{5^{x-1}}{25} = 1$

$$\begin{aligned} 5^{x-1} &= 25 \\ x-1 &= 2 \\ x &= 3 \end{aligned}$$

check

$$\begin{array}{l} \text{LS} \\ \frac{5^{3-1}}{25} \\ = \frac{25}{25} \\ = 1 \quad \checkmark \\ \text{RS} \end{array}$$

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9(e)  $5^{y+2} = 1$   
 $5^{y+2} = 5^0$   
 $y+2 = 0$   
 $y = -2$

check  
 $\frac{LS}{5^{-2+2}} = \frac{RS}{1}$   
 $= 5^0 = 1$  ✓

9(f)  $4^{2x+1} = 8$   
 $(2^2)^{2x+1} = 2^3$   
 $2^{4x+2} = 2^3$   
 $4x+2 = 3$   
 $4x = 1$   
 $x = \frac{1}{4}$

check  
 $\frac{LS}{4^{2(\frac{1}{4})+1}} = \frac{RS}{8}$   
 $= 4^{\frac{1}{2}+1}$   
 $= 4^{\frac{1}{2}+\frac{2}{2}}$   
 $= 4^{\frac{3}{2}}$   
 $= (\sqrt{4})^3 = 8$  ✓

9(g)  $2(3^{n+2}) = 18$   
 $3^{n+2} = 9$   
 $3^{n+2} = 3^2$   
 $n+2 = 2$   
 $n = 0$

check  
 $\frac{LS}{2(3^{0+2})} = \frac{RS}{18}$   
 $= 2(9) = 18$  ✓

9(h)  $4^{x-2} + 1 = 5$   
 $4^{x-2} = 4$   
 $x-2 = 1$   
 $x = 3$

check  
 $\frac{LS}{4^{3-2}+1} = \frac{RS}{5}$   
 $= 4+1 = 5$  ✓

10 a)  $2^{x+5} = 2^{2x-1}$   
 $x+5 = 2x-1$   
 $5+1 = 2x-x$   
 $6 = x$

b)  $27^{x-2} = 3^{x+6}$   
 $(3^3)^{x-2} = 3^{x+6}$   
 $3x-6 = x+6$   
 $3x-x = 6+6$   
 $2x = 12$   
 $x = 6$

c)  $8^{2m+2} = 16^{m-2}$   
 $(2^3)^{2m+2} = (2^4)^{m-2}$   
 $6m+6 = 4m-8$   
 $6m-4m = -8-6$   
 $2m = -14$   
 $m = -7$

d)  $5^{y-1} = 25^{2y-1}$   
 $y-1 = 2(2y-1)$   
 $y-1 = 4y-2$   
 $-1+2 = 4y-y$   
 $1 = 3y$   
 $y = \frac{1}{3}$

e)  $4^{2t+1} = 8^{2t-1}$   
 $(2^2)^{2t+1} = (2^3)^{2t-1}$   
 $4t+2 = 6t-3$   
 $5 = 2t$   
 $\frac{5}{2} = t$

f)  $6^{3x+5} = 36^{3x+6}$   
 $6^{3x+5} = (6^2)^{3x+6}$   
 $3x+5 = 6x+12$   
 $5-12 = 6x-3x$   
 $-7 = 3x$   
 $x = -\frac{7}{3}$

11(a)  $2^{x+3} + 2^x = 288$

$$2^x(2^3 + 1) = 288$$

$$2^x(9) = 288$$

$$2^x = \frac{288}{9}$$

$$2^x = 32$$

$$x = 5$$

b)  $3^{g+3} - 3^{g+2} = 1458$

$$3^{g+2}(3 - 1) = 1458$$

$$3^{g+2} = \frac{1458}{2}$$

$$3^{g+2} = 729$$

$$3^{g+2} = 3^6$$

$$g+2 = 6$$

$$g = 4$$

Let  $t$  be time in ~~years~~ <sup>hours</sup>,  $P$  - population of bacteria

c)  $-500 = 5^{y+1} - 5^{y+2}$

$$-500 = 5^{y+1}(1 - 5)$$

$$\frac{-500}{-4} = 5^{y+1}$$

$$125 = 5^{y+1}$$

$$5^3 = 5^{y+1}$$

$$y+1 = 3$$

$$y = 2$$

12.  $P = P_0(2)^{\frac{t}{3.75}}$

$$7680000 = 30000(2)^{\frac{t}{3.75}}$$

$$256 = 2^{\frac{t}{3.75}}$$

$$2^8 = 2^{\frac{t}{3.75}}$$

$$\frac{t}{3.75} = 8$$

$$t = 30$$

∴ it will take 30 hours.

13. a)  $(\underline{5x^2} - \underline{4x} - \underline{2}) + (\underline{8x^2} + \underline{3x} - \underline{3})$   
 $= 13x^2 - x - 5$

b)  $(2x^2 - 6xy + 7y^2) + (4x^2 + 3xy - 11y^2)$   
 $= 6x^2 - 3xy - 4y^2$

14. a)  $7y^2 + 4y - 7 - (9y^2 + 3y - 3)$   
 $= 7y^2 + 4y - 7 - 9y^2 - 3y + 3$   
 $= -2y^2 + y - 4$

b)  $3m^2 + mn - 7n^2 - (5m^2 + 3mn - 8n^2)$   
 $= 3m^2 + mn - 7n^2 - 5m^2 - 3mn + 8n^2$   
 $= -2m^2 - 2mn + n^2$

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$$\begin{aligned} 15a) & 4(x+5) + 3(x-7) \\ & = 4x + 20 + 3x - 21 \\ & = 7x - 1 \end{aligned}$$

$$\begin{aligned} b) & 6(3s-4t) - (7s-t) + 5 \\ & = 18s - 24t - 7s + t + 5 \\ & = 11s - 23t + 5 \end{aligned}$$

$$\begin{aligned} c) & 2x(x+3) - x(3x+8) \\ & = 2x^2 + 6x - 3x^2 - 8x \\ & = -x^2 - 2x \end{aligned}$$

$$\begin{aligned} d) & 3y(y-2) + 2y(3y+4) - 4y(2y-3) \\ & = 3y^2 - 6y + 6y^2 + 8y - 8y^2 + 12y \\ & = y^2 + 14y \end{aligned}$$

$$(16a) \quad 3[4 - 2(y-3)] + 4[3(2-y) - 5]$$

$$= 3[4 - 2y + 6] + 4[6 - 3y - 5]$$

$$= 3(10 - 2y) + 4(1 - 3y)$$

$$= 30 - 6y + 4 - 12y$$

$$= 34 - 18y$$

$$\begin{aligned} 16b) & 2x[2 - x(x-1)] - [3 - x(x+20)] \\ & = 2x[2 - x^2 + x] - [3 - x^2 - 20x] \end{aligned}$$

$$= 4x - 2x^3 + 2x^2 - 3 + x^2 + 20x$$

$$= -2x^3 + 3x^2 + 24x - 3$$

$$\begin{aligned} 17a) & (y-8)(y-9) \\ & = y^2 - 17y + 72 \end{aligned}$$

$$\begin{aligned} b) & 2(7-3x)(4+x) \\ & = 2(28 + 7x - 12x - 3x^2) \\ & = 56 - 10x - 6x^2 \\ & = -6x^2 - 10x + 56 \end{aligned}$$

$$\begin{aligned} c) & 3(3x-1)^2 \\ & = 3(9x^2 - 6x + 1) \\ & = 27x^2 - 18x + 3 \end{aligned}$$

$$\begin{aligned} d) & (4x+3y)(2x-5y) \\ & = 8x^2 - 20xy + 6xy - 15y^2 \\ & = 8x^2 - 14xy - 15y^2 \end{aligned}$$