Homework Answer

Chapter 2: Indices and surds

2A Irrational numbers including surds

1.

3√2	5√2	6√2	10√2
4√2	3√3	6√3	5√6
10√3	7√2	8√2	6√5

2.

8√2	15√2	24√2	15√2
18√5	21√3	40√3	63√2
100√2	40√3	24√2	42√5
2√2	√2	√2	√2
√2	√6	2√3	2√2

3.

2√5/9	2√7/7	√2/2	√7/3
2√15/9	√7/3	√2/2	4/5

2B Adding and subtracting surds

1.

1) $6\sqrt{2}$	2) $-2\sqrt{7}$
3) $4\sqrt{5} + 2\sqrt{3} + 8$	4) $2\sqrt{x} + 7\sqrt{y}$
5) $3\sqrt{10} + 7\sqrt{11}$	6) $11\sqrt{2} + 3\sqrt{5}$
7) $3\sqrt{3} + 4\sqrt{7}$	8) $18\sqrt{x} - 2\sqrt{y}$
9) $-2\sqrt{6}$	10) $6\sqrt{x} + 3\sqrt{y}$

2.

1) $6\sqrt{2}$	2) $8\sqrt{2}$
3) $6\sqrt{3}$	4) $8\sqrt{5}$
5) $6\sqrt{6}$	6) $7\sqrt{3} + 2\sqrt{2}$
7) $8\sqrt{2}$	8) $8\sqrt{11}$
9) $5\sqrt{7}$	10) $2\sqrt{5}$

3.

1) $3\sqrt{a} - \sqrt{2a}$	2) $33\sqrt{2a}$
3) $8a - 7\sqrt{3a}$	4) $6\sqrt{3ab}$
5) $a\sqrt{a} + a^2\sqrt{a}$	6) $5a\sqrt{ab} + 3\sqrt{ab}$
7) $4a - 2\sqrt{2a}$	8) $7a\sqrt{3a}$

4.

1) $\frac{7\sqrt{2}}{6}$	2) $\frac{3\sqrt{2}}{2}$	3) 0	4) $\frac{12\sqrt{5}}{5}$
5) $\frac{\sqrt{2}}{6}$	6) $2\sqrt{3}$	7) $-\frac{\sqrt{2}}{2}$	8) $\frac{31\sqrt{2}}{12}$

5.

Expression 1

$$2\sqrt{5} + \sqrt{20} - 4\sqrt{5}.$$

1. Factor inside $\sqrt{20}$:

$$\sqrt{20} = \sqrt{4 \times 5} = 2\sqrt{5}.$$

2. Substitute back:

$$2\sqrt{5} + 2\sqrt{5} - 4\sqrt{5} = (2 + 2 - 4)\sqrt{5} = 0.$$

Result: 0.

Expression 2

$$\sqrt{8} + \sqrt{18} - \sqrt{2} - \sqrt{32}.$$

1. Factor inside each surd:

$$\sqrt{8} = \sqrt{4 \times 2} = 2\sqrt{2}, \quad \sqrt{18} = \sqrt{9 \times 2} = 3\sqrt{2}, \quad \sqrt{32} = \sqrt{16 \times 2} = 4\sqrt{2}.$$

2. Substitute back:

$$(2\sqrt{2}) + (3\sqrt{2}) - \sqrt{2} - (4\sqrt{2}) = (2 + 3 - 1 - 4)\sqrt{2} = 0.$$

Result: 0.

Expression 3

$$3\sqrt{3} \;+\; \sqrt{27} \;-\; 6\sqrt{3}.$$

1. Factor $\sqrt{27}$:

$$\sqrt{27} = \sqrt{9 \times 3} = 3\sqrt{3}.$$

2. Substitute back:

$$3\sqrt{3} \;+\; 3\sqrt{3} \;-\; 6\sqrt{3} = (3+3-6)\sqrt{3} = 0.$$

Result: 0.

Expression 4

$$\sqrt{12} \;-\; \sqrt{27} \;+\; \sqrt{3}.$$

1. Factor where possible:

$$\sqrt{12} = \sqrt{4 \times 3} = 2\sqrt{3}, \quad \sqrt{27} = \sqrt{9 \times 3} = 3\sqrt{3}.$$

2. Substitute back:

$$2\sqrt{3} \;-\; 3\sqrt{3} \;+\; \sqrt{3} = (2-3+1)\sqrt{3} = 0.$$

Result: 0.

Expression 5

$$2\sqrt{7} \;+\; \sqrt{28} \;-\; 4\sqrt{7}.$$

1. Factor $\sqrt{28}$:

$$\sqrt{28} = \sqrt{4 \times 7} = 2\sqrt{7}.$$

2. Substitute back:

$$2\sqrt{7} \;+\; 2\sqrt{7} \;-\; 4\sqrt{7} = (2+2-4)\sqrt{7} = 0.$$

Result: 0.

Expression 6

$$4\sqrt{2} \;-\; \sqrt{32} \;+\; \sqrt{8} \;-\; 2\sqrt{2}.$$

1. Simplify each surd:

$$\sqrt{32} = \sqrt{16 \times 2} = 4\sqrt{2}, \quad \sqrt{8} = \sqrt{4 \times 2} = 2\sqrt{2}.$$

2. Substitute back into the expression:

$$4\sqrt{2} \;-\; 4\sqrt{2} \;+\; 2\sqrt{2} \;-\; 2\sqrt{2} \;=\; (4-4+2-2)\sqrt{2} \;=\; 0.$$

Result: 0.

Expression 7

$$\sqrt{50} \;-\; 5\sqrt{2} \;+\; \sqrt{8} \;-\; 2\sqrt{2}.$$

1. Simplify each surd:

$$\sqrt{50} = \sqrt{25 \times 2} = 5\sqrt{2}, \quad \sqrt{8} = \sqrt{4 \times 2} = 2\sqrt{2}.$$

2. Substitute back:

$$5\sqrt{2} \;-\; 5\sqrt{2} \;+\; 2\sqrt{2} \;-\; 2\sqrt{2} \;=\; (5-5+2-2)\sqrt{2} \;=\; 0.$$

Result: 0.

Expression 8

$$3\sqrt{5} \;+\; \sqrt{45} \;-\; 6\sqrt{5}.$$

1. Factor $\sqrt{45}$:

$$\sqrt{45} = \sqrt{9 \times 5} = 3\sqrt{5}.$$

2. Substitute back:

$$3\sqrt{5} \;+\; 3\sqrt{5} \;-\; 6\sqrt{5} = (3+3-6)\sqrt{5} = 0.$$

Result: 0.

2C Multiplying and dividing surds

1.

(1) $6\sqrt{10}$ $(2\sqrt{2} \times 3\sqrt{5} = 6\sqrt{10})$	(2) $16\sqrt{3}$ $(\sqrt{8} \times 4\sqrt{6} = 16\sqrt{3})$	(3) $25\sqrt{2}$ $(5\sqrt{10} \times \sqrt{5} = 25\sqrt{2})$
(4) $21x\sqrt{x}$ $(3\sqrt{x} \times 7\sqrt{x^2} = 21x\sqrt{x})$	(5) $6x^4$ $(\sqrt{4x^3} \times \sqrt{9x^5} = 6x^4)$	(6) 10 $(\frac{1}{2}\sqrt{20} \times 2\sqrt{5} = 10)$
(7) $36a\sqrt{a}$ $(2\sqrt{3a} \times 3\sqrt{12a^2} = 36a\sqrt{a})$	(8) $30b^2$ $(\frac{1}{3}\sqrt{45b^3} \times 6\sqrt{5b} = 30b^2)$	(9) 40 $(4\sqrt{50} \times \sqrt{2} = 40)$
(10) 30 $(2\sqrt{75} \times \sqrt{3} = 30)$	(11) $4x^2y\sqrt{xy}$ $(\sqrt{8x^2y} \times \sqrt{2x^3y^2} = 4x^2y\sqrt{xy})$	(12) $12x^3\sqrt{6x}$ $(3\sqrt{2x^4} \times 4\sqrt{3x^3} = 12x^3\sqrt{6x})$
(13) $20a^2b^2\sqrt{3a}$ $(5\sqrt{6a^2b^3} \times 2\sqrt{2a^3b} = 20a^2b^2\sqrt{3a})$	(14) $42x^3y^2\sqrt{2xy}$ $(2\sqrt{7x^5y^2} \times 3\sqrt{14x^2y^3} = 42x^3y^2\sqrt{2xy})$	(15) $\sqrt{3}$ $(\frac{1}{4}\sqrt{96} \times \frac{1}{2}\sqrt{2} = \sqrt{3})$
(16) 15 $(\frac{2}{5}\sqrt{125} \times \frac{3}{2}\sqrt{5} = 15)$	(17) $18x^3$ $(6\sqrt{3x^4} \times \frac{1}{3}\sqrt{27x^2} = 18x^3)$	(18) $4x^4$ $(\sqrt{x^3} \times 4\sqrt{x^5} = 4x^4)$

2.

1) 2	2) 5	3) $\sqrt{3}$	4) 4
5) 1	6) $\frac{3}{2}$	7) 1	8) 2
9) 1	10) 1	11) $\sqrt{3x}$	12) $\sqrt{5x}$
13) $2a$	14) 1	15) $\dfrac{a\sqrt{3}}{b}$	16) $2\sqrt{\frac{y}{x}}$
17) a	18) $2x^2$	19) $x^2\sqrt{y}$	20) $\dfrac{y\sqrt{y}}{x^2}$

3.

(1) $\sqrt{2}(\sqrt{3} + 2\sqrt{5})$
$= \sqrt{2}\cdot\sqrt{3} + \sqrt{2}\cdot2\sqrt{5} = \sqrt{6} + 2\sqrt{10}$

(2) $-2\sqrt{5}(\sqrt{7} + \sqrt{2})$
$= -2\sqrt{5}\cdot\sqrt{7} - 2\sqrt{5}\cdot\sqrt{2} = -2\sqrt{35} - 2\sqrt{10}$

(3) $\sqrt{7}(3\sqrt{5} - 5\sqrt{7})$
$= 3\sqrt{35} - 5\cdot7 = 3\sqrt{35} - 35$

(4) $3\sqrt{2}(2\sqrt{5} + \sqrt{3})$
$= 3\sqrt{2}\cdot2\sqrt{5} + 3\sqrt{2}\cdot\sqrt{3} = 6\sqrt{10} + 3\sqrt{6}$

(5) $-4\sqrt{3}(\sqrt{6} - 2\sqrt{2})$
$= -4\sqrt{18} + 8\sqrt{6} = -4\cdot3\sqrt{2} + 8\sqrt{6} = -12\sqrt{2} + 8\sqrt{6}$

(6) $5\sqrt{2}(\sqrt{8} + \sqrt{10})$
$= 5\sqrt{16} + 5\sqrt{20} = 5\cdot4 + 5\cdot2\sqrt{5} = 20 + 10\sqrt{5}$

2D Rationalising the denominator

1.

(1) $\frac{3\sqrt{2}}{2}$	(2) $\frac{11\sqrt{5}}{5}$	(3) $\frac{2\sqrt{7}}{21}$	(4) $\frac{5\sqrt{2}}{8}$
(5) $\frac{\sqrt{42}}{7}$	(6) $\frac{\sqrt{5}}{5}$	(7) $\sqrt{6}$	(8) $\frac{\sqrt{15}}{7}$
(9) $\frac{4\sqrt{3}}{3}$	(10) $\frac{\sqrt{3}}{2}$	(11) $\sqrt{6}$	(12) $\frac{\sqrt{10}}{4}$
(13) $\sqrt{3}$	(14) $5\sqrt{2}$	(15) $\frac{7\sqrt{5}}{10}$	(16) $\frac{\sqrt{2}}{2}$

2.

(1) $\frac{\sqrt{3}}{2}$	(2) $\frac{2\sqrt{5}}{5}$	(3) $\frac{\sqrt{10}}{4}$	(4) $\frac{\sqrt{6}}{3}$
(5) $\frac{\sqrt{14}}{7}$	(6) $\frac{\sqrt{30}}{3}$	(7) $\frac{3\sqrt{14}}{14}$	(8) $\sqrt{5}$
(9) $\frac{\sqrt{21}}{6}$	(10) $\frac{2\sqrt{22}}{11}$	(11) $\frac{\sqrt{30}}{6}$	(12) $\frac{\sqrt{33}}{3}$
(13) $\frac{2\sqrt{15}}{5}$	(14) $\frac{3\sqrt{13}}{13}$	(15) $\frac{\sqrt{42}}{4}$	(16) $\frac{\sqrt{22}}{11}$

3.

1) $\dfrac{\sqrt{10}+2\sqrt{5}}{2}$	2) $\dfrac{3\sqrt{30}-10\sqrt{3}}{5}$	3) $\dfrac{14\sqrt{2}+3\sqrt{14}}{14}$	4) $3\sqrt{2}$
5) $\dfrac{11\sqrt{2}}{2}$	6) $\dfrac{\sqrt{33}+6\sqrt{11}}{3}$	7) $\dfrac{2\sqrt{14}-\sqrt{42}}{8}$	8) $\dfrac{5\sqrt{2}}{2}-\sqrt{10}$

4.

1) $\sqrt{3}-\sqrt{2}$	2) $3(\sqrt{2}+1)=3\sqrt{2}+3$	3) $2+\sqrt{3}$	4) $\dfrac{11+4\sqrt{6}}{5}$
5) $2-\sqrt{3}$	6) $\dfrac{2(\sqrt{5}+\sqrt{2})}{3}$	7) $3\sqrt{7}-8$	8) $\dfrac{2\sqrt{10}+4\sqrt{5}-5\sqrt{2}-5}{3}$
9) $\dfrac{12-4\sqrt{2}}{7}$	10) $2-\sqrt{3}$	11) $9-4\sqrt{5}$	12) $\dfrac{6+2\sqrt{2}}{7}$

2E Review of index laws

1.

$\frac{3}{10}x^5$	$4y^9$	$\frac{5}{4}a^3b^4$
$10p^5q^5$	$\frac{3}{2}m^7n^3$	$14r^7$
$\frac{2}{3}u^5v^3$	$3s^9$	$6x^{10}$
$\frac{1}{2}a^3$	$4c^6d^4$	$\frac{2}{5}w^6$

$2x^3$	$5y^4$	$3m^4n$	$3pq^4$
$3a^2b$	$5r^5s^3$	$2t^3u^2$	$3z^6$
$\frac{2c^3}{d}$	$2h^2k$	$5x^2y^2$	$5g^4$
$81b^8$	$\frac{x^6}{4y^2}$	$125p^{12}q^3$	$\frac{8m^3}{n^6}$
$16t^{10}$	$\frac{27r^6}{s^3}$	$4u^8v^6$	$\frac{p^4}{9q^{10}}$
$\frac{16a^6b^2}{c^2}$	$343k^6$	$\frac{n^{20}}{16}$	$36w^4x^6$

2.

$3x^9y^2$	$2a^3b$
$\frac{1}{2}m^5n^5$	$3p^{12}q^4$
$2r^5s^2$	$4u^7v^2$

2F Negative indices

1.

$\dfrac{1}{a^5}$	$\dfrac{3}{x^7}$	$\dfrac{6\,z^3}{y}$	$\dfrac{2\,p^5}{q^2}$
$\dfrac{9\,s^2}{r^4\,t^3}$	$\dfrac{4}{7\,a^2}$	$2\,b^3$	$\dfrac{5\,d^2}{6\,c^4}$
$\dfrac{q^4}{3\,p^2}$	$\dfrac{7\,x^5}{y^2}$	$\dfrac{2\,c^2\,b^5}{3\,a^3}$	$\dfrac{3\,z^5\,x^2}{2\,y^3}$
$\dfrac{5\,q}{2\,p^4\,r^3}$	$\dfrac{9\,t^4}{r^2\,s}$	$\dfrac{n^5}{2\,m^4}$	$\dfrac{c^3}{a^2\,b^4}$
$\dfrac{6\,g^7}{f^3}$	$\dfrac{2\,t^2}{s^3}$	$\dfrac{4\,w^3}{u^6\,v}$	$8\,h^4\,k^2$
$\dfrac{2\,c\,b^5}{9\,a^2\,d^2}$	$\dfrac{2\,f^2}{3\,e^5}$	$\dfrac{7\,p^4\,n^2}{2\,m^3}$	$\dfrac{3\,z}{x^2\,y^4}$
$\dfrac{2\,d^4}{a^5\,b^2\,c^3}$	$\dfrac{1}{a^2\,b^3\,c}$	$\dfrac{2\,q^6}{3\,p^6}$	$\dfrac{2\,z^3}{x^2\,y}$

2.

$\dfrac{2\,x^{12}}{y}$	$\dfrac{a^5}{8\,b^{19}}$
$\dfrac{8\,n^{10}}{m^3}$	$\dfrac{128}{q^3}$
$\dfrac{27\,y^3}{2\,x^2}$	$\dfrac{50}{r^2\,s^3}$
$\dfrac{4\,b^{18}}{3\,a^{13}}$	$\dfrac{9}{4}\,k^{17}$

3G Scientific notation

1.

345	607,000	90,010	0.0056
0.00002105	80,050,000	0.0003021	1,234,000
0.070001	4,020,000,000	0.00000006334	1006
295	0.00000000502	0.000009875	120,000,000
34,010	0.0000006015	27.5	0.0005333
1256	704,000	901.23	0.0003105
0.000002	45,670,000	0.00000006666	0.012345

2.

2.3×10^4 (2)	-5.60×10^5 (3)	9.0×10^{-4} (2)	3×10^5 (1)
-3.04×10^{-3} (3)	8.75×10^7 (3)	1.230×10^{-3} (4)	-1.0×10^4 (2)
6.70×10^2 (3)	4.4×10^{-7} (2)	1.00×10^6 (3)	-5.00×10^{-2} (3)
1.2×10^2 (2)	3.8×10^{-4} (2)	-2.47×10^5 (3)	7.5×10^2 (2)
1.00×10^1 (3)	-9.100×10^6 (4)	3.26×10^{-6} (3)	4.0×10^5 (2)
-2.0×10^{-3} (2)	-8×10^{-2} (1)	1.2×10^5 (2)	-3.3×10^{-1} (2)

3H Rational indices

1.

$8^{1/3} = 2$	$25^{1/2} = 5$	$36^{3/2} = 216$	$32^{-1/5} = 1/2$
$49^{1/2} = 7$	$27^{2/3} = 9$	$16^{1/4} = 2$	$64^{-3/2} = 1/512$

2.

$a^{\frac{1}{4}} \times a^{\frac{3}{4}} = a$	$\dfrac{b^{2/5} c^{3/10}}{b^{1/5} b^{1/5} c^{3/10}} =$	$(x^2 y^3)^{1/4} \times x^{3/4} = x^{5/4} y^{3/4}$
$\left(\dfrac{p^{2/3} q^{3/2}}{p^{1/6}}\right)^{1/2} = p^{1/4} q^{3/4}$	$\dfrac{a^{3/5}}{b^{1/2}} \times a^{2/5} b^{1/2} = a$	$\dfrac{(m^4 n^3)^{1/2}}{m^{3/2} n^{1/4}} = m^{1/2} n^{5/4}$

3.

$45^{1/2}$	$x^{5/3}$	$(a^2 b^3)^{1/4}$	$72^{1/2}$
$64^{1/3}$	$m^{-4/3}$	$(2x^3)^{1/4}$	$(p^2 q^3)^{1/2}$
$50^{1/2}$	$81^{1/3}$	$(2x^4)^{1/2}$	$(m^5)^{1/4} = m^{5/4}$
$(a^2 b^4)^{1/3}$	$(x^5 y^2)^{1/2}$	$\left(\dfrac{5 p^3}{q^4}\right)^{1/2}$	$(3c^2)^{1/2}$

3I Exponential equations

1.

$2^x = 16 \implies$ $x = 4$	$3^x = \frac{1}{27} \implies$ $x = -3$	$9^x = 3 \implies$ $x = \frac{1}{2}$	$\left(\frac{1}{2}\right)^x =$ $\frac{1}{8} \implies x = 3$
$8^x = \frac{1}{32} \implies$ $x = -\frac{5}{3}$	$4^x = \frac{1}{16} \implies$ $x = -2$	$3^x = 81 \implies$ $x = 4$	$16^x = 2 \implies$ $x = \frac{1}{4}$
$3^x = \frac{1}{27} \implies$ $x = -3$	$2^{x+1} =$ $\frac{1}{16} \implies x = -5$	$4^{-x} = \frac{1}{64} \implies$ $x = 3$	$9^{x-2} =$ $\frac{1}{81} \implies x = 0$
$5^{-x} =$ $\frac{1}{125} \implies x = 3$	$6^x = 36 \implies$ $x = 2$	$\left(\frac{1}{3}\right)^x =$ $\frac{1}{81} \implies x = 4$	$8^{1-x} =$ $\frac{1}{2} \implies x = \frac{4}{3}$

2.

$9^x = 27 \implies$ $x = \frac{3}{2}$	$2^{x+2} =$ $32 \implies x = 3$	$25^{-x} =$ $\frac{1}{5} \implies x = \frac{1}{2}$	$\left(\frac{1}{2}\right)^x = 8 \implies$ $x = -3$
$4^{x-1} =$ $8 \implies x = \frac{5}{2}$	$81^{1-x} =$ $\frac{1}{9} \implies x = \frac{3}{2}$	$3^{2x} = \frac{1}{81} \implies$ $x = -2$	$16^{-x} =$ $\frac{1}{256} \implies x = 2$

3.

1. **Initial investment**: $8,000

2. **Value after 7 years** (nearest dollar): $12,301

3. **Number of years until exceeding $20,000**: 15 years

3J Graphs of exponentials

1.

$\left(\frac{3}{2}\right)^x$ – Increasing

$\left(\frac{1}{10}\right)^x$ – Decreasing

4^{-x} – Decreasing

$\left(2.5\right)^{-x}$ – Decreasing

$\left(\frac{5}{7}\right)^x$ – Decreasing

$\left(0.99\right)^x$ – Decreasing

$\left(\frac{1}{2}\right)^{-x}$ – Increasing

$\left(3.01\right)^{-x}$ – Decreasing

2.

a.

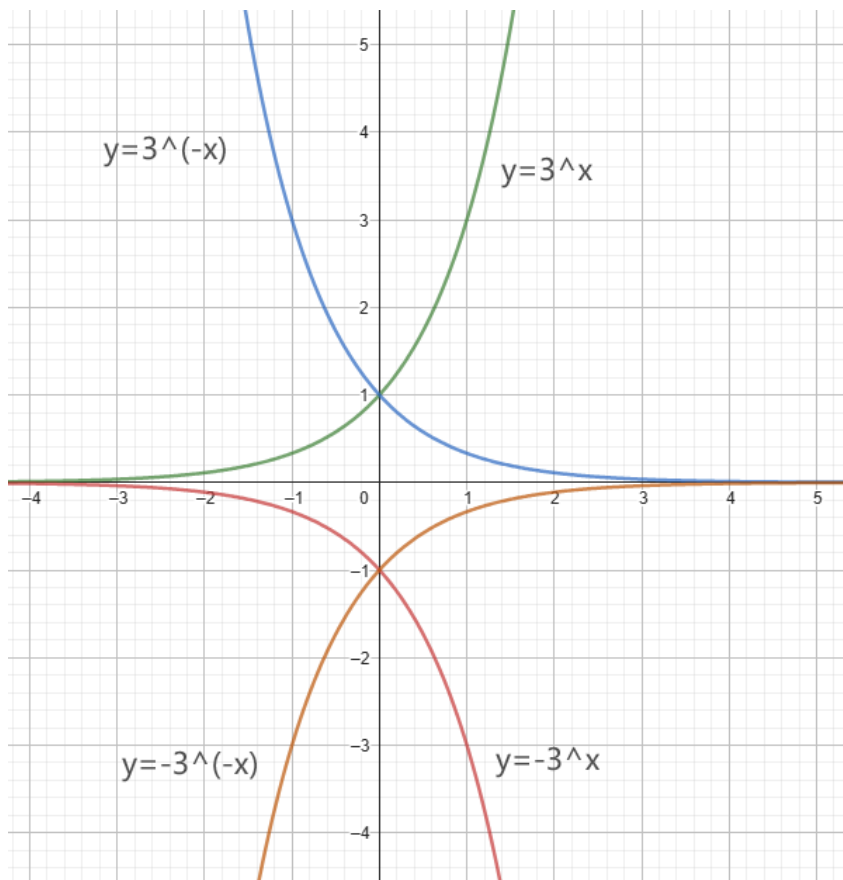| x	-3	-2	-1	0	1	2	3
y	-1/8	-1/4	-1/2	-1	-2	-4	-8

b.
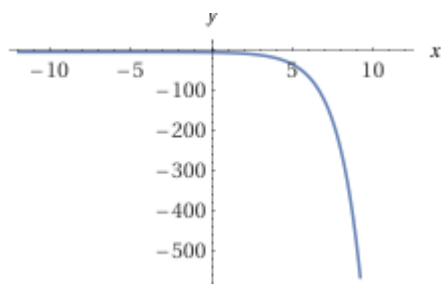
c. y-values will decrease as x increases

d. y-values will increase (approach to 0) as x decreases

e. no, as x decreases, the y-values will approach to 0 but never touch 0

f. y=-1

3.

3K Exponential growth and decay

1.

Car Increasing 12% Annually

a. $V = 8000 \, (1.12)^n$.

b. $V(2) \approx \$100{,}352, \ V(5) \approx \$141{,}083.$

c. Exceeds $120k after $\boxed{3.6}$ years (approx).

2.

Smartphone Depreciating 15% Annually

a. $V = 1200 \, (0.85)^n$.

b. After 3 years: $\boxed{\$737}$.

c. After 7 years: $\boxed{\$385}$.

d. Falls below $100 after $\boxed{15.3}$ years (approx).

3.

Bacteria 5% Growth Per Hour

a. $P = 4000 \, (1.05)^t$.

b. After 6 hours: $\boxed{5{,}360}$ bacteria, after 12 hours: $\boxed{7{,}183}$ bacteria.

c. Reaches 10,000 about $\boxed{18.8}$ hours.

d. Stays below 12,500 for up to $\boxed{23.3}$ hours (approx).

3L Compound interest

1.

Annual compounding ($A = P(1 + \frac{r}{100})^n$):

- (a) $2,500 @3.8% 2yr: $2,693.60
- (b) $6,400 @4.25% 5yr: $7,886.54
- (c) $10,500 @6% 3yr: $12,506.67
- (d) $20,000 @5.5% 4yr: $24,769.80
- (e) $3,200 @7.1% 6yr: $4,834.02
- (f) $9,750 @4.9% 5yr: $12,366.75
- (g) $15,000 @2.75% 2yr: $15,833.33
- (h) $18,300 @3.6% 8yr: $24,357.66

2.

Various compounding frequencies ($A = P(1 + \frac{r/100}{m})^{mn}$):

- (a) $2,800 @3.2% semiannual 5yr: $3,267.60
- (b) $9,400 @4.9% quarterly 6.5yr: $12,657.22
- (c) $15,000 @6.15% monthly 4yr: $19,292.55
- (d) $18,000 @7.5% quarterly 10yr: $38,094.30
- (e) $33,500 @9.2% semiannual 7yr: $60,156.92
- (f) $4,750 @5.25% monthly 3yr: $5,556.79
- (g) $86,000 @8.6% quarterly 12yr: $239,275.00 (approx)
- (h) $20,000 @2.75% semiannual 3yr: $21,693.40

3.

Jacob invests $12,000 at 6.5% p.a. for 2 years

(a) **Monthly** compounding final: $13,668.72 (approx).

(b) **Quarterly** compounding final: $13,625.88 → The difference is $42.84 more with monthly.

4.

Car $28,000 Depreciating 18%

(a) After 3 years: $15,438.30 (approx).

(b) Half (~$14,000) after ~3.5 years.

5.

Emily invests $45,000 at 4.6%

(a) Semiannual formula: $A = 45000(1 + 0.046/2)^{10}$.

(b) Final (semiannual) $56,632.05 (approx).

(c) Monthly compounding $\approx \$56,348.55$. A small difference of a few hundred dollars.

6.

Laptop $2,400

Loses 25% after first year → $1,800.

Then 10% yearly (reducing-balance).

1. After 1 year: $1,800.

2. After 2 years: $1,620.

3. Falls below $500 after about 13.1 years in total; so it's under $500 during the **14th** year.