EXERCISE SET 4 ANSWER KEY

No Calculator

1. **3** $2a^2 + 3a - 5a^2 = 9$
Simplify: $3a - 3a^2 = 9$
Divide by 3: $a - a^2 = 3$

2. **5** $(200)(4{,}000) = 800{,}000 = 8 \times 10^5$

3. **1/8 or .125** $\frac{8w^2}{(8w)^2}$
Exponential Law #5: $\frac{8w^2}{64w^2}$
Cancel common factors: $\frac{1}{8}$

4. **510** $5(2^{2x}) + 2^x$
Exponential Law #8: $5(2^x)^2 + 2^x$
Substitute $2^x = 10$: $5(10)^2 + 10$
Simplify: $5(10)^2 + 10 = 510$

5. **64** If $(x + 2)(x + 4)(x + 6) = 0$, then $x = -2, -4$, or -6. Therefore 2^{-x} could equal 2^2, 2^4, or 2^6. The greatest of these is $2^6 = 64$.

6. **80** $\left(4+4\sqrt{2}\right)^2$
FOIL: $(4)^2 + 2(4)\left(4\sqrt{2}\right) + \left(4\sqrt{2}\right)^2$
Simplify: $16 + 32\sqrt{2} + 32$
Simplify: $48 + 32\sqrt{2}$
Therefore $a = 48$ and $b = 32$ and $a + b = 80$.

7. **8** $\frac{a}{3+\sqrt{5}} = \frac{3-\sqrt{5}}{b}$
Cross-multiply: $ab = \left(3+\sqrt{5}\right)\left(3-\sqrt{5}\right)$
Simplify: $ab = 9 - 5 = 4$
Therefore $ab^{3/2} = 4^{3/2} = 8$

8. **5/3 or 1.66 or 1.67** $9^x = 25$
Substitute $9 = 3^2$: $(3^2)^x = 25$
Exponential Law #8: $3^{2x} = 25$
Take square root: $3^x = 5$
Divide by 3: $\frac{3^x}{3^1} = \frac{5}{3}$
Exponential Law #6: $3^{x-1} = \frac{5}{3}$

9. **B** $\frac{g(4a,2b)}{g(a,b)} = \frac{\frac{2(4a)}{(2b)^3}}{\frac{2a}{b^3}}$
Simplify: $= \frac{2(4a)}{(2b)^3} \times \frac{b^3}{2a}$
Simplify: $= \frac{8ab^3}{16ab^3} = \frac{1}{2}$

10. **C** $\frac{2^n \times 2^n}{2^n \times 2}$
Cancel common factor: $\frac{2^n}{2^1}$
Exponential Law #6: 2^{n-1}

11. **A** $3^m + 3^m + 3^m$
Combine like terms: $3(3^m)$
Exponential Law #4: 3^{m+1}

12. **B** $5y^2$
Substitute $y = 5^x$: $5(5^x)^2$
Exponential Law #8: $5(5^{2x})$
Exponential Law #4: 5^{2x+1}

Calculator

13. **64** $n^2 = \sqrt{64^4}$
Radical Law #1 $n^2 = (64^4)^{1/2}$
Exponential Law #8: $n^2 = 64^2$

14. **5** $\frac{1}{10^m} < 0.000025$
Scientific Notation: $1 \times 10^{-m} < 2.5 \times 10^{-5}$
Substitution and checking makes it clear that $m = 5$ is the smallest integer that satisfies the inequality.

15. **2.5** $\frac{3}{3^{-k}} = 9\sqrt{27}$
Exponential Law #6: $3^{1-(-k)} = 9\sqrt{27}$
Simplify: $3^{k+1} = 9 \times 3\sqrt{3}$
Express as exponentials: $3^{k+1} = 3^2 \times 3 \times 3^{\frac{1}{2}}$
Exponential Law #4: $3^{k+1} = 3^{3.5}$
Exponential Law #10: $k + 1 = 3.5$
Subtract 1: $k = 2.5$

16. **7** $(x^m)^3(x^{m+1})^2 = x^{37}$
Exponential Law #8: $(x^{3m})(x^{2m+2}) = x^{37}$
Exponential Law #4: $x^{5m+2} = x^{37}$
Exponential Law #10: $5m + 2 = 37$
Subtract 2: $5m = 35$
Divide by 5: $m = 7$

17. **6** $9\sqrt{12} - 4\sqrt{27} = n\sqrt{3}$
Factor: $9\sqrt{4} \times \sqrt{3} - 4\sqrt{9} \times \sqrt{3} = n\sqrt{3}$

Divide by $\sqrt{3}$: $9\sqrt{4}-4\sqrt{9}=n$

Simplify: $18-12=6=n$

---

18. **6** $8^{\frac{1}{6}}=\left(2^{-\frac{1}{12}}\right)^{-n}$

Substitute $8=2^3$: $(2^3)^{\frac{1}{6}}=\left(2^{-\frac{1}{12}}\right)^{-n}$

Exponential Law #8: $2^{\frac{1}{2}}=2^{\frac{n}{12}}$

Exponential Law #10: $\frac{1}{2}=\frac{n}{12}$

Multiply by 12: $6=n$

---

19. **$1<x\leq 1.56$** $0<\frac{4}{5}x<\sqrt{x}<x$

Middle inequality: $\frac{4}{5}x<\sqrt{x}$

Square both sides: $\frac{16}{25}x^2<x$

Divide by x: $\frac{16}{25}x<1$

(Since $x>0$, we do not "swap" the inequality.)

Multiply by 25/16: $x<\frac{25}{16}=1.563$

Last inequality: $\sqrt{x}<x$

Square both sides: $x<x^2$

Divide by x: $1<x$

Therefore, x must be both greater than 1 and less than or equal to 1.56.

---

20. **B** $\frac{4}{2^{-2}(x+x)(x+x)}$

Simplify: $\frac{4\times 2^2}{(2x)^2}$

Simplify: $\frac{16}{4x^2}$

Cancel common factor: $\frac{4}{x^2}$

---

21. **B** Translate: $\sqrt{x}=2x$

Square both sides: $x=4x^2$

Divide by $4x$: $\frac{1}{4}=x$

---

22. **D** $\frac{2m\sqrt{2n}+m\sqrt{18n}}{m\sqrt{2}}$

Factor terms: $\frac{2m\sqrt{2}\sqrt{n}+m\sqrt{9}\sqrt{2}\sqrt{n}}{m\sqrt{2}}$

Cancel common factors: $2\sqrt{n}+\sqrt{9}\sqrt{n}$

Combine like terms: $2\sqrt{n}+3\sqrt{n}=5\sqrt{n}$

---

23. **B** Pythagorean Theorem: $1^2+x^2=\left(\sqrt{n}\right)^2$

Simplify: $1+x^2=n$

Subtract 1: $x^2=n-1$

Take square root: $x=\sqrt{n-1}$