Knowledge Checklist These are the bits the exam board wants you to know, make sure you can do all of these…	Self-assessment			Where to go if you don't under stand	
	First review 4-7 months before exam	Second review 1-2 months before exam	Final review Week before exam	Primrose Kitten	Other places
I can recognise that *a x b* is equal to *ab*	☺ 😐 ☹	☺ 😐 ☹	☺ 😐 ☹	https://youtu.be/UcGbqIvtseE	
I can recognise that *4a* is equal to *a + a + a + a* or *4 x a*	☺ 😐 ☹	☺ 😐 ☹	☺ 😐 ☹		TuitionKit http://bit.ly/2x4Bjam
I can recognise that y^2 is equal to *y x y*	☺ 😐 ☹	☺ 😐 ☹	☺ 😐 ☹		TuitionKit http://bit.ly/2kbs3Qu
I can recognise that $\frac{a}{b}$ is equal to $a \div b$	☺ 😐 ☹	☺ 😐 ☹	☺ 😐 ☹		TuitionKit http://bit.ly/2yOioT5
I can use *a x b* is equal to *ab*	☺ 😐 ☹	☺ 😐 ☹	☺ 😐 ☹		
I can use *4a* is equal to *a + a + a + a* or *4 x a*	☺ 😐 ☹	☺ 😐 ☹	☺ 😐 ☹		
I can use y^2 is equal to *y x y*	☺ 😐 ☹	☺ 😐 ☹	☺ 😐 ☹		
I can use $\frac{a}{b}$ is equal to $a \div b$	☺ 😐 ☹	☺ 😐 ☹	☺ 😐 ☹		
I can collect like terms in an algebraic expression	☺ 😐 ☹	☺ 😐 ☹	☺ 😐 ☹		
I can put numbers into an algebraic expression and if needed calculate an answer	☺ 😐 ☹	☺ 😐 ☹	☺ 😐 ☹	https://youtu.be/h7i_qwLL7s8	TuitionKit http://bit.ly/2fyAMqN
I can multiply out a number in front of a bracket	☺ 😐 ☹	☺ 😐 ☹	☺ 😐 ☹		TuitionKit http://bit.ly/2wVFchO
I can factorise an algebraic expression by taking out common factors	☺ 😐 ☹	☺ 😐 ☹	☺ 😐 ☹		TuitionKit http://bit.ly/2fGIqDf
I can multiply two expressions	☺ 😐 ☹	☺ 😐 ☹	☺ 😐 ☹	https://youtu.be/WikXr23klJI	TuitionKit http://bit.ly/2wVFchO

I can factorise $x^2 + bx + c$	☺ 😐 ☹	☺ 😐 ☹	☺ 😐 ☹		TuitionKit http://bit.ly/2kaUKwR
I can simplify an algebraic expression	☺ 😐 ☹	☺ 😐 ☹	☺ 😐 ☹		
I can rearrange an algebraic expression to change the subject	☺ 😐 ☹	☺ 😐 ☹	☺ 😐 ☹	https://youtu.be/L--GzM_nddE	TuitionKit http://bit.ly/2xIeF9q
I can use and manipulate surds	☺ 😐 ☹	☺ 😐 ☹	☺ 😐 ☹	https://youtu.be/KfCtSYdvQoc	TuitionKit http://bit.ly/2wqmvDo
I can use the laws of indices	☺ 😐 ☹	☺ 😐 ☹	☺ 😐 ☹		TuitionKit http://bit.ly/2fyF7dz
I can use functions	☺ 😐 ☹	☺ 😐 ☹	☺ 😐 ☹		TuitionKit http://bit.ly/2xFO3bD
I can plot and determine coordinate from a graph	☺ 😐 ☹	☺ 😐 ☹	☺ 😐 ☹		
I can plot a line from the expression $y = mx + c$	☺ 😐 ☹	☺ 😐 ☹	☺ 😐 ☹		TuitionKit http://bit.ly/2xSbIVW
I can identify parallel lines from the expression $y = mx + c$	☺ 😐 ☹	☺ 😐 ☹	☺ 😐 ☹		TuitionKit http://bit.ly/2xSbIVW
I can determine the expression $y = mx + c$ from a graph	☺ 😐 ☹	☺ 😐 ☹	☺ 😐 ☹		TuitionKit http://bit.ly/2xSbIVW
I can find the gradient of a line	☺ 😐 ☹	☺ 😐 ☹	☺ 😐 ☹		TuitionKit http://bit.ly/2wplFGJ
I can find the intercept of a line	☺ 😐 ☹	☺ 😐 ☹	☺ 😐 ☹		
I can identify roots from a graph	☺ 😐 ☹	☺ 😐 ☹	☺ 😐 ☹		
I can identify intercepts from a graph	☺ 😐 ☹	☺ 😐 ☹	☺ 😐 ☹		
I can identify turning points from a graph	☺ 😐 ☹	☺ 😐 ☹	☺ 😐 ☹		
I can recognise and sketch the graphs for linear functions	☺ 😐 ☹	☺ 😐 ☹	☺ 😐 ☹		
I can recognise and sketch the graphs for quadratic functions	☺ 😐 ☹	☺ 😐 ☹	☺ 😐 ☹		TuitionKit http://bit.ly/2yNtzvs

I can recognise and sketch the graphs for cubic functions	☺ 😐 ☹	☺ 😐 ☹	☺ 😐 ☹		
I can recognise and sketch the graphs for $\frac{1}{x}$	☺ 😐 ☹	☺ 😐 ☹	☺ 😐 ☹		
I can plot graphs	☺ 😐 ☹	☺ 😐 ☹	☺ 😐 ☹		
I can interpret distance-time graphs	☺ 😐 ☹	☺ 😐 ☹	☺ 😐 ☹		
I can interpret velocity-time graphs	☺ 😐 ☹	☺ 😐 ☹	☺ 😐 ☹		
I can solve an equation	☺ 😐 ☹	☺ 😐 ☹	☺ 😐 ☹		TuitionKit http://bit.ly/2yfcxcH
I can find approximate solutions to an equation from a graph	☺ 😐 ☹	☺ 😐 ☹	☺ 😐 ☹		TuitionKit http://bit.ly/2kaJpgj
I can solve quadratic equations by factorising	☺ 😐 ☹	☺ 😐 ☹	☺ 😐 ☹		
I can solve two simultaneous equations	☺ 😐 ☹	☺ 😐 ☹	☺ 😐 ☹	https://youtu.be/y5BKXkTwHTU	TuitionKit http://bit.ly/2x3Yuq0
I can make equations from a situation given in text	☺ 😐 ☹	☺ 😐 ☹	☺ 😐 ☹		
I can solve linear inequalities and show the answer on a number line	☺ 😐 ☹	☺ 😐 ☹	☺ 😐 ☹		TuitionKit http://bit.ly/2xS7Xjj
I can find terms in a sequence from the n^{th} term	☺ 😐 ☹	☺ 😐 ☹	☺ 😐 ☹		TuitionKit http://bit.ly/2x40S07
I can find the n^{th} term from a sequence	☺ 😐 ☹	☺ 😐 ☹	☺ 😐 ☹		
I can recognise and use square numbers	☺ 😐 ☹	☺ 😐 ☹	☺ 😐 ☹		
I can recognise and use cube numbers	☺ 😐 ☹	☺ 😐 ☹	☺ 😐 ☹		
I can recognise and use triangular numbers	☺ 😐 ☹	☺ 😐 ☹	☺ 😐 ☹		
Higher tier only					
I can simplify algebraic expression involving fractions	☺ 😐 ☹	☺ 😐 ☹	☺ 😐 ☹		
I can factorise quadratic equations ($ax^2 + bx + c$)	☺ 😐 ☹	☺ 😐 ☹	☺ 😐 ☹		TuitionKit http://bit.ly/2fFU7d4

I can use algebra to construct proofs	☺ 😐 ☹	☺ 😐 ☹	☺ 😐 ☹	https://youtu.be/nkzLA4c2sA0	
I can interpret inverse functions	☺ 😐 ☹	☺ 😐 ☹	☺ 😐 ☹		TuitionKit http://bit.ly/2fyD0Gv
I can interpret composite functions	☺ 😐 ☹	☺ 😐 ☹	☺ 😐 ☹		TuitionKit http://bit.ly/2xNOa47
I can identify perpendicular line from a graph	☺ 😐 ☹	☺ 😐 ☹	☺ 😐 ☹		
I can identify turning points on a graph by completing the square	☺ 😐 ☹	☺ 😐 ☹	☺ 😐 ☹		
I can recognise, sketch and interpret graphs for exponential functions	☺ 😐 ☹	☺ 😐 ☹	☺ 😐 ☹		TuitionKit http://bit.ly/2yPqV8y
I can recognise, sketch and interpret graphs for trigonometric functions (sin, cos and tan)	☺ 😐 ☹	☺ 😐 ☹	☺ 😐 ☹		
I can sketch translations of a functions	☺ 😐 ☹	☺ 😐 ☹	☺ 😐 ☹		
I can sketch transformations of a function	☺ 😐 ☹	☺ 😐 ☹	☺ 😐 ☹		TuitionKit http://bit.ly/2yO6Sas
I can plot and interpret exponential graphs	☺ 😐 ☹	☺ 😐 ☹	☺ 😐 ☹		
I can calculate and estimate the gradients of graphs	☺ 😐 ☹	☺ 😐 ☹	☺ 😐 ☹		
I can calculate and estimate the area under a graph	☺ 😐 ☹	☺ 😐 ☹	☺ 😐 ☹		
I can determine distance from a distance time graph	☺ 😐 ☹	☺ 😐 ☹	☺ 😐 ☹		
I can determine speed from a distance time graph	☺ 😐 ☹	☺ 😐 ☹	☺ 😐 ☹		
I can determine distance from a velocity time graph	☺ 😐 ☹	☺ 😐 ☹	☺ 😐 ☹		
I can determine speed from a velocity time graph	☺ 😐 ☹	☺ 😐 ☹	☺ 😐 ☹		
I can use the equation of a circle to find the equation of a tangent	☺ 😐 ☹	☺ 😐 ☹	☺ 😐 ☹		TuitionKit http://bit.ly/2x4Vwww

I can solve quadratic equations by completing the square	☺ 😐 ☹	☺ 😐 ☹	☺ 😐 ☹		TuitionKit http://bit.ly/2yzzi6Y
I can solve quadratic equations by using the quadratic formula	☺ 😐 ☹	☺ 😐 ☹	☺ 😐 ☹		TuitionKit http://bit.ly/2x4WyJb
I can find approximate solutions to an equation using iteration	☺ 😐 ☹	☺ 😐 ☹	☺ 😐 ☹		TuitionKit http://bit.ly/2ygxBiE
I can solve linear inequalities using a graph	☺ 😐 ☹	☺ 😐 ☹	☺ 😐 ☹		
I can find the n^{th} term for quadratic sequences	☺ 😐 ☹	☺ 😐 ☹	☺ 😐 ☹		TuitionKit http://bit.ly/2wpuyAj

#1 Collecting like terms in an algebraic expression

Video link; https://youtu.be/UcGbqIvtseE

- I can use a x b is equal to ab
- I can use 4a is equal to a + a + a + a or 4 x a
- I can use y^2 is equal to y x y
- I can use a/b is equal to a ÷ b
- I can collect like terms in an algebraic expression

For each of the following rewrite it in its simplest form.

Easy

1. $x \times y$
2. $t + t + t$
3. $5 \times f$
4. $e \times e \times e$
5. $x \div y$
6. $2a \times 4b$
7. $x \times 5y \times 4z$
8. $7d + 4d$
9. $2e + 6e - 3e$
10. $x^2 + x^2 + x^2 + x^2$
11. $3 \times e \times f$
12. $\frac{5y}{10}$
13. $\frac{6ab}{2b}$
14. $8ab \times 3ac$
15. $5f + 6e - 2f + 3e$

Medium

1. $2\sqrt{5} - 8 + 4\sqrt{5} + 2$
2. $7 - 2\sqrt{3} - 5 + 4\sqrt{3}$
3. $9\sqrt{7} + 6 - 4\sqrt{7} + 2$
4. $8\sqrt{10} + 7 - 3\sqrt{10} - 12$
5. $6\sqrt{2} - 3 - 5\sqrt{2} + 9$
6. $8\sqrt{5} + 7 - \sqrt{5} + 3$
7. $2\sqrt{7} + 6 - 5\sqrt{7} + 5$
8. $3\sqrt{2} + 7\sqrt{5} - \sqrt{2} - 2\sqrt{5}$
9. $8\sqrt{7} + 3\sqrt{3} + 2\sqrt{7} - 5\sqrt{3}$
10. $3\sqrt{10} - 2\sqrt{5} + \sqrt{10} - \sqrt{5}$
11. $12\sqrt{2} + 7\sqrt{3} - 9\sqrt{2} + \sqrt{2}$
12. $7\sqrt{5} - 6\sqrt{7} - 4\sqrt{5} + 2\sqrt{7}$
13. $3\sqrt{10} - 8\sqrt{2} - 7\sqrt{10} - 3\sqrt{2}$
14. $7\sqrt{2} + 3\sqrt{3} - 4\sqrt{5} - \sqrt{2} + 2\sqrt{3}$
15. $5\sqrt{6} - 8\sqrt{7} + 2\sqrt{10} + 2\sqrt{6} + 4\sqrt{7} - \sqrt{10}$

#2 Putting numbers into an algebraic expression

Video link; https://youtu.be/h7i_gwLL7s8

- I can put numbers into an algebraic expression and if needed calculate an answer

Easy

1. Find the value of e when f = 4	$e = 5f - 2$
2. Find the value of T when a = 2 and b = 3	$T = 7a - b^2$
3. Find b when x = 2 and y = 9	$b = \frac{4x+10}{y}$
4. Find x when y = 7 and z = -2	$x = 3y + 2z$
5. Find c when f = 50	$c = \frac{5}{9}(f - 32)$
6. Find d when t = 4 and v = -3	$d = 3t^2 - 5v$
7. Find v when u = 12, a = -4 and t = 1	$v = u + at$
8. Find s when u = $\frac{1}{2}$, t = 6 and a = -1	$s = ut + \frac{1}{2}at^2$
9. Find y when x = - $\frac{1}{2}$ and w = 5	$y = 4x^2 - 2w$
10. Find a when b = 2 and c = -8	$a = \frac{3b^2+c}{5}$
11. Find f when d = 6 and e = 7	$f = \sqrt{5d - 2e}$
12. Find x when a = 6 and b = -1	$x = \frac{a^2}{3} - 2b$
13. Find p when r = 2 and s = -3	$p = rs^2 + r^2s$
14. Find y when a = 5, b = 4 and c = -3	$y = \sqrt{a^2b} + \frac{5c}{2}$
15. Find a when x = -7 and y = 1.2	$a = 2(x - 3)^2 - 5y^2$

#3 Multiplying out a number in front of a bracket

Video link; https://youtu.be/aOKx403YuZY

- I can multiply out a number in front of a bracket

Easy

1. $4(x + 7)$
2. $8(a - 3)$
3. $3(c - 1)$
4. $5(3x - 2)$
5. $2(7a + 3)$
6. $9(4d + 7)$
7. $6(8e - 2)$
8. $7(5f - 1)$
9. $3(-2x + 7)$
10. $8(-5y + 1)$
11. $7(-3a - 2)$
12. $2(-6t + 9)$
13. $-5(-7a + 2)$
14. $-6(-3d - 4)$
15. $-4(-8x - 1)$

#4 Factorising algebraic expressions

Video link; https://youtu.be/mebC9_5lEDw

- I can factorise an algebraic expression by taking out common factors

Easy

1. $3x + 9$
2. $8y + 6$
3. $24a - 16$
4. $10f - 25$
5. $2e + 8$
6. $9x - 15$
7. $21d + 14$
8. $15y - 9$
9. $4a - 6b$
10. $3e + 12f$
11. $9x - 27y$
12. $5c - 5d$
13. $12x - 7xy$
14. $11 + 5ab$
15. $19d - 3cd$

Medium

1. $3x^2 + 5x$
2. $7a^2 - 2a$
3. $4f^2 - 9f$
4. $19d^2 + 12d$
5. $2e^2 - 6e$
6. $9y^2 + 12y$
7. $4c^2 + 8c$
8. $21t^2 - 7t$
9. $16r^3 - 12r^2$
10. $15d^2 + 10d^3$
11. $7g^4 + 28g^2$
12. $27t^3 - 15t^2$
13. $11x^5 + 33x^3$
14. $10a^4 - 25a^3$
15. $4e^2 - 14e^5$

#9 Indices. Non calculator.

This worksheet is fully supported by a video tutorial; https://youtu.be/HGHRWMw6sGQ

Easy

Simplify the following…

1. $x^5 \times x^3$
2. $y^7 \times y^4$
3. $f^6 \times f^{-2}$
4. $\frac{e^{12}}{e^4}$
5. $\frac{a^{18}}{a^3}$
6. $\frac{x^8}{x^2}$
7. $(y^5)^2$
8. $(f^3)^4$
9. $(e^2)^3$
10. a^0
11. $\frac{x^7 \times x^8}{x^{12}}$
12. $\frac{(y^8)^3}{y^6}$
13. $\frac{f^{15}}{f^5} \times f^4$
14. $(e^7 \times e^3)^2$
15. $\frac{(x^4)^3}{x}$

Medium

1. Write 5^{-2} as a fraction.
2. Write $\frac{1}{e^7}$ in the form a^{-m}
3. Write 2^{-4} as a fraction.
4. Simplify $x^7 \div \frac{1}{x^2}$
5. Simplify $e^{12} \div \frac{1}{e^5}$
6. Simplify $f^9 \times (f^3)^{-2}$
7. Evaluate $3^3 \times 4^{-2}$
8. Evaluate $2^5 \times 4^{-3}$
9. Evaluate $100^{\frac{1}{2}}$
10. Evaluate $125^{\frac{1}{3}}$
11. Evaluate $(\frac{1}{16})^{\frac{1}{4}}$
12. Evaluate $64^{\frac{2}{3}}$
13. Evaluate $4^{\frac{3}{2}}$
14. Evaluate $(\frac{8}{64})^{\frac{2}{3}}$
15. Evaluate $(\frac{27}{125})^{\frac{2}{3}}$

Hard

1. Evaluate $125^{-\frac{1}{3}}$
2. Evaluate $81^{-\frac{1}{4}}$
3. Evaluate $64^{-\frac{2}{3}}$
4. Evaluate $16^{-\frac{2}{4}}$
5. Evaluate $32^{-\frac{3}{5}}$
6. Evaluate $1000^{-\frac{4}{3}}$
7. Express $x \times \sqrt[3]{x}$ as a power of x
8. Express $y^2 \times \sqrt[2]{y}$ as a power of y
9. Write $16\sqrt{2}$ as a power of 2
10. Write $\frac{27}{81}$ as a power of 3
11. Express $\sqrt[5]{16}$ as a power of 2
12. Express $\sqrt[3]{9}$ as a power of 3
13. Express $\frac{32}{\sqrt{16}}$ as a power of 2
14. Express $\frac{27}{\sqrt[3]{81}}$ as a power of 3
15. Express $\frac{25}{\sqrt[4]{125}}$ as a power of 5

Answers

Answers-collecting like terms

Easy

1. $x \times y$	xy
2. $t + t + t$	$3t$
3. $5 \times f$	$5f$
4. $e \times e \times e$	e^3
5. $x \div y$	$\frac{x}{y}$
6. $2a \times 4b$	$8ab$
7. $x \times 5y \times 4z$	$20xyz$
8. $7d + 4d$	$11d$
9. $2e + 6e - 3e$	$5e$
10. $x^2 + x^2 + x^2 + x^2$	$4x^2$
11. $3 \times e \times f$	$3ef$
12. $\frac{5y}{10}$	$\frac{y}{2}$
13. $\frac{6ab}{2b}$	$3a$
14. $8ab \times 3ac$	$24a^2bc$
15. $5f + 6e - 2f + 3e$	$9e + 3f$

Medium

1. $2\sqrt{5} - 8 + 4\sqrt{5} + 2$	$6\sqrt{5} - 6$
2. $7 - 2\sqrt{3} - 5 + 4\sqrt{3}$	$2\sqrt{3} + 2$
3. $9\sqrt{7} + 6 - 4\sqrt{7} + 2$	$5\sqrt{7} + 8$
4. $8\sqrt{10} + 7 - 3\sqrt{10} - 12$	$5\sqrt{10} - 5$
5. $6\sqrt{2} - 3 - 5\sqrt{2} + 9$	$\sqrt{2} + 6$
6. $8\sqrt{5} + 7 - \sqrt{5} + 3$	$7\sqrt{5} + 10$
7. $2\sqrt{7} + 6 - 5\sqrt{7} + 5$	$11 - 3\sqrt{5}$
8. $3\sqrt{2} + 7\sqrt{5} - \sqrt{2} - 2\sqrt{5}$	$2\sqrt{2} + 5\sqrt{5}$
9. $8\sqrt{7} + 3\sqrt{3} + 2\sqrt{7} - 5\sqrt{3}$	$10\sqrt{7} - 2\sqrt{3}$
10. $3\sqrt{10} - 2\sqrt{5} + \sqrt{10} - \sqrt{5}$	$4\sqrt{10} - 3\sqrt{5}$
11. $12\sqrt{2} + 7\sqrt{3} - 9\sqrt{2} + \sqrt{2}$	$3\sqrt{2} + 8\sqrt{3}$
12. $7\sqrt{5} - 6\sqrt{7} - 4\sqrt{5} + 2\sqrt{7}$	$3\sqrt{5} - 4\sqrt{7}$
13. $3\sqrt{10} - 8\sqrt{2} - 7\sqrt{10} - 3\sqrt{2}$	$-4\sqrt{10} - 11\sqrt{2}$
14. $7\sqrt{2} + 3\sqrt{3} - 4\sqrt{5} - \sqrt{2} + 2\sqrt{3}$	$6\sqrt{2} + 5\sqrt{3} - 4\sqrt{3}$

15. $5\sqrt{6} - 8\sqrt{7} + 2\sqrt{10} + 2\sqrt{6} + 4\sqrt{7} - \sqrt{10}$ $7\sqrt{6} - 4\sqrt{7} + \sqrt{10}$

Answers- putting numbers into an algebraic expression

Easy

1. Find the value of e when f = 4	$e = 5f - 2$	18
2. Find the value of T when a = 2 and b = 3	$T = 7a - b^2$	5
3. Find b when x = 2 and y = 9	$b = \frac{4x+10}{y}$	2
4. Find x when y = 7 and z = -2	$x = 3y + 2z$	17
5. Find c when f = 50	$c = \frac{5}{9}(f - 32)$	10
6. Find d when t = 4 and v = -3	$d = 3t^2 - 5v$	63
7. Find v when u = 12, a = -4 and t = 1	$v = u + at$	16
8. Find s when u = $\frac{1}{2}$, t = 6 and a = -1	$s = ut + \frac{1}{2}at^2$	-15
9. Find y when x = $-\frac{1}{2}$ and w = 5	$y = 4x^2 - 2w$	-9
10. Find a when b = 2 and c = -8	$a = \frac{3b^2+c}{5}$	0.8
11. Find f when d = 6 and e = 7	$f = \sqrt{5d - 2e}$	4
12. Find x when a = 6 and b = -1	$x = \frac{a^2}{3} - 2b$	14
13. Find p when r = 2 and s = -3	$p = rs^2 + r^2s$	6
14. Find y when a = 5, b = 4 and c = -3	$y = \sqrt{a^2b} + \frac{5c}{2}$	2.5
15. Find a when x = -7 and y = 1.2	$a = 2(x - 3)^2 - 5y^2$	192.8

Answers- multiplying out numbers in front of a bracket

1. $4(x + 7)$	$4x + 28$
2. $8(a - 3)$	$8a - 24$
3. $3(c - 1)$	$3c - 3$
4. $5(3x - 2)$	$15x - 10$
5. $2(7a + 3)$	$14a + 6$
6. $9(4d + 7)$	$36d + 63$
7. $6(8e - 2)$	$48e - 12$
8. $7(5f - 1)$	$35f - 7$
9. $3(-2x + 7)$	$-6x + 21$
10. $8(-5y + 1)$	$-40y + 8$

11. 7(-3a – 2) -21a - 14
12. 2(-6t + 9) -12t + 18
13. -5(-7a + 2) 35a - 10
14. -6(-3d – 4) 18d + 24
15. -4(-8x -1) 32x + 4

Answers-factorising expressions

Easy

1. 3x + 9 3(x + 3)
2. 8y + 6 2(4y + 3)
3. 24a – 16 8(3a – 2)
4. 10f – 25 5(2f – 5)
5. 2e + 8 2(e + 4)
6. 9x – 15 3(3x - 5)
7. 21d + 14 7(3d + 2)
8. 15y – 9 3(5y -3)
9. 4a – 6b 2(2a – 3b)
10. 3e + 12f 3(e + 4f)
11. 9x - 27y 9(x - 3y)
12. 5c – 5d 5(c – d)
13. 12x -7xy x(12 – 7y)
14. 11 + 5ab a(11 + 5b)
15. 19d – 3cd d(19 – 3c)

Medium

1. 3x^2 + 5x x(3x + 5)
2. 7a^2 – 2a a(7a – 2)
3. 4f^2 – 9f f(4f – 9)
4. 19d^2 + 12d d(19d + 12)
5. 2e^2 – 6e 2e(e – 3)
6. 9y^2 + 12y 3y(3y + 4)
7. 4c^2 + 8c 4c(c + 2)
8. 21t^2 – 7t 7t(3t – 1)

9. $16r^3 - 12r^2$ — $4r^2(4r - 3)$
10. $15d^2 + 10d^3$ — $5d^2(3 + 2d)$
11. $7g^4 + 28g^2$ — $7g^2(g^2 + 4)$
12. $27t^3 - 15t^2$ — $3t^2(9t - 5)$
13. $11x^5 + 33x^3$ — $11x^3(x^2 + 3)$
14. $10a^4 - 25a^3$ — $5a^3(2a - 5)$
15. $4e^2 - 14e^5$ — $2e^2(2 - 7e^3)$

Answers

Easy

1. $x^5 \times x^3$ — x^8
2. $y^7 \times y^4$ — y^{11}
3. $f^6 \times f^{-2}$ — f^4
4. $\frac{e^{12}}{e^4}$ — e^8
5. $\frac{a^{18}}{a^3}$ — a^{15}
6. $\frac{x^8}{x^2}$ — x^6
7. $(y^5)^2$ — y^{10}
8. $(f^3)^4$ — f^{12}
9. $(e^2)^3$ — e^6
10. a^0 — 1
11. $\frac{x^7 \times x^8}{x^{12}}$ — x^3
12. $\frac{(y^8)^3}{y^6}$ — y^{18}
13. $\frac{f^{15}}{f^5} \times f^4$ — f^{14}
14. $(e^7 \times e^3)^2$ — e^{20}
15. $\frac{(x^4)^3}{x}$ — x^{11}

medium

1. Write 5^{-2} as a fraction. — $\frac{1}{25}$
2. Write $\frac{1}{e^7}$ in the form a^{-m} — x^{-7}
3. Write 2^{-4} as a fraction. — $\frac{1}{16}$

4. Simplify $x^7 \div \frac{1}{x^2}$ x^9
5. Simplify $e^{12} \div \frac{1}{e^5}$ e^{-11}
6. Simplify $f^9 \times (f^3)^{-2}$ f^{12}
7. Evaluate $3^3 \times 4^{-2}$ $\frac{27}{16}$
8. Evaluate $2^5 \times 4^{-3}$ $\frac{1}{2}$
9. Evaluate $100^{\frac{1}{2}}$ 10
10. Evaluate $125^{\frac{1}{3}}$ 5
11. Evaluate $(\frac{1}{16})^{\frac{1}{4}}$ $\frac{1}{2}$
12. Evaluate $64^{\frac{2}{3}}$ 16
13. Evaluate $4^{\frac{3}{2}}$ 8
14. Evaluate $(\frac{8}{64})^{\frac{2}{3}}$ $\frac{1}{4}$
15. Evaluate $(\frac{27}{125})^{\frac{2}{3}}$ $\frac{9}{25}$

Hard

1. Evaluate $125^{-\frac{1}{3}}$ $\frac{1}{2}$
2. Evaluate $81^{-\frac{1}{4}}$ $\frac{1}{3}$
3. Evaluate $64^{-\frac{2}{3}}$ $\frac{1}{16}$
4. Evaluate $16^{-\frac{2}{4}}$ $\frac{1}{4}$
5. Evaluate $32^{-\frac{3}{5}}$ $\frac{1}{8}$
6. Evaluate $1000^{-\frac{4}{3}}$ $\frac{1}{10{,}000}$
7. Express $x \times \sqrt[3]{x}$ as a power of x x
8. Express $y^2 \times \sqrt[2]{y}$ as a power of y $y^{\frac{7}{2}}$
9. Write $16\sqrt{2}$ as a power of 2 $2^{\frac{9}{2}}$
10. Write $\frac{27}{81}$ as a power of 3 3^{-1}
11. Express $\sqrt[5]{16}$ as a power of 2 $2^{\frac{4}{5}}$
12. Express $\sqrt[3]{9}$ as a power of 3 $3^{\frac{2}{3}}$
13. Express $\frac{32}{\sqrt{16}}$ as a power of 2 2^3
14. Express $\frac{27}{\sqrt[3]{81}}$ as a power of 3 $3^{\frac{2}{3}}$
15. Express $\frac{25}{\sqrt[4]{125}}$ as a power of 5 $5^{\frac{5}{4}}$