Practice Paper 1

Expansion and factorisation | Algebraic fractions | Quadratics

Name: _____ Class: _____ Date: _____

30 questions | Answer all questions and show your working.

Give exact answers unless a level of accuracy is stated.

A calculator may be used except where a question states otherwise.

1. Expand and simplify.

$$(2p-3q)^2-(p+1q)(p-1q)$$

2. Factorise completely.

$2x^3-32x$

3. Given $(x-y)^2=49$ and $xy=12$, find $3x^2+3y^2$ without finding x or y.

4. Simplify the expression. Hence evaluate the numerical expression without squaring the four large numbers.

$x^2-(x-1)^2+(x-2)^2-(x-3)^2$

$2031^2-2030^2+2029^2-2028^2$

5. Factorise completely.

$x^2+2x-15$

6. Factorise completely.

$6x^2-5x-6$

7. Factorise completely.

$4m^2+16mn+16n^2$

8. Factorise completely by grouping.

$6ac-4ad-3bc+2bd$

9. Factorise completely.

$(x+4)^2-4$

10. Factorise completely.

$x^3+2x^2-49x-98$

11. Simplify. Assume a and b are non-zero.

$$\frac{3a}{5b^2}\times\frac{2}{ab}\div\frac{1}{b^2}$$

12. Simplify, and state all restrictions on x and y from the original expression.

$$\frac{4x^2-y^2}{2x+y} \times \frac{2}{x^2-9}$$

13. Express as a single fraction in its simplest form.

$$\frac{3x}{4} - \frac{2(3-2x)}{5}$$

14. Express as a single fraction in its simplest form. State the excluded value of x.

$$\frac{2}{4-x}-\frac{5}{(x-4)^2}$$

15. Simplify and state every value of x excluded by the original expression.

$$\frac{x^2-4}{x^2+7x+10}\div\frac{x-2}{x+5}$$

16. Solve the equation. State any excluded values of x.

$$\frac{1}{x-2}+\frac{1}{x+2}=\frac{6}{5}$$

17. A student cancels x from the numerator and denominator of the fraction below and writes $\frac{x+3}{2}$. Explain the error and give the correct simplified expression.

$$\frac{x^2+3x}{2x+1}$$

18. Solve by factorisation.

$$x^2-2x-8=0$$

19. Solve by factorisation. Give exact answers.

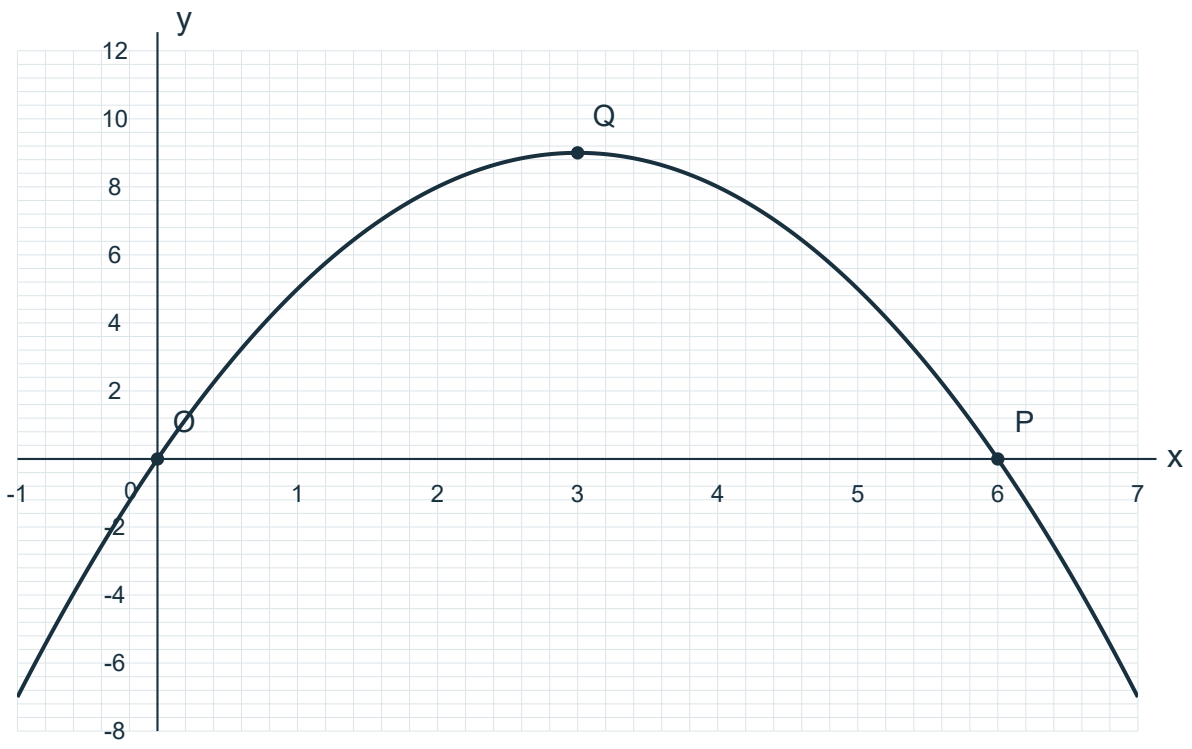
$6x^2-5x-6=0$

20. Two numbers p and q satisfy $p+q=9$ and $pq=4$. Find the following without finding p or q.

(a) p^2+q^2

(b) $(p-q)^2$

21. The graph of $y=6x-x^2$ is shown.



Use the numbered scale on each axis.

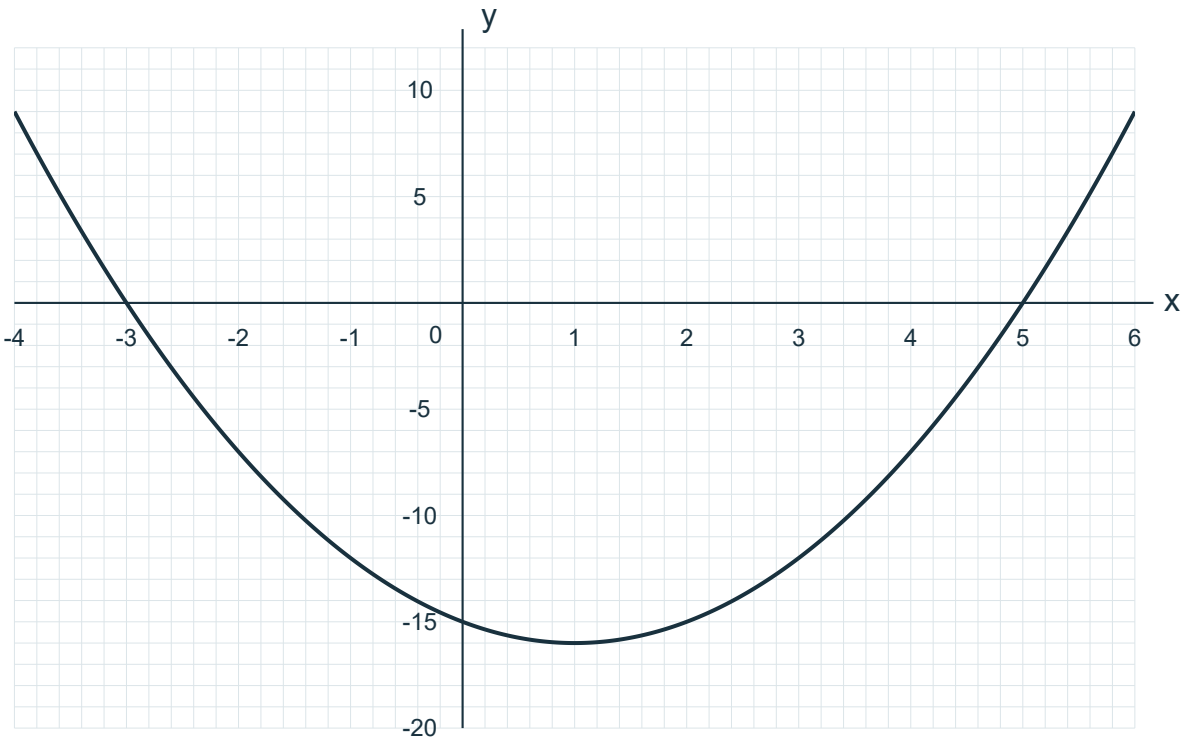
(a) Write the coordinates of the second x-intercept P.

(b) Write the equation of the line of symmetry.

(c) Find the maximum point Q.

(d) Find the area of triangle OPQ, where O is the origin.

22. The curve $y=(x+3)(x-5)$ is shown.



Use the numbered scale on each axis.

(a) Find both x-intercepts.

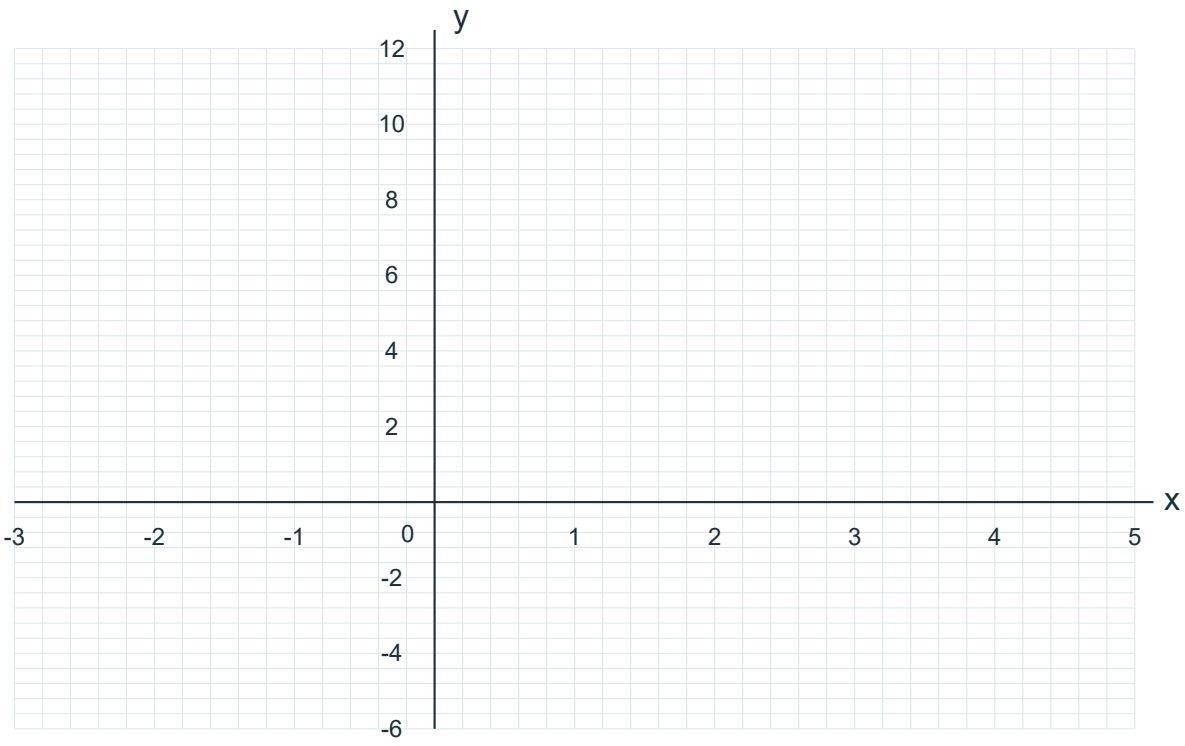
(b) Find the y-intercept.

(c) Find the minimum point.

(d) Write the equation of the line of symmetry.

23. For $y=(x-1)^2-4$, complete the table and draw the graph on the grid. Mark its turning point and line of symmetry.

x	-2	-1	0	1	2	3	4
y							



Use the numbered scale on each axis.

(a) Complete the table.

(b) Draw the graph and mark the requested features.

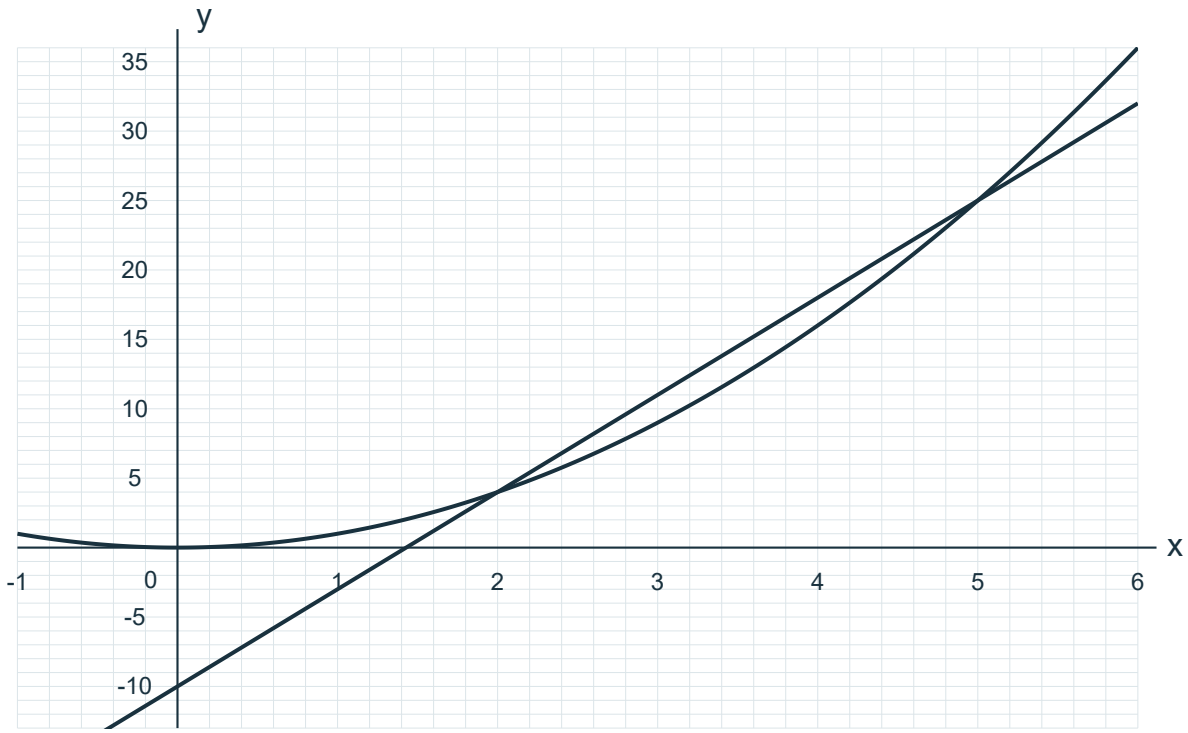
24. A quadratic graph has equation $y=x^2+bx+c$. Its minimum point is (2, -7).

(a) Find b and c.

(b) Write the equation in completed-square form.

(c) Find the y-intercept.

25. The curve $y=x^2$ and the line $y=7x-10$ are shown.



Use the numbered scale on each axis.

(a) Find their intersection points algebraically.

(b) Solve $x^2-7x+10=0$.

(c) For what values of x is the curve below the line?

26. A rectangle has width x cm and length 3 cm more than its width. Its area is 54 cm².

(a) Form an equation in x.

(b) Find both dimensions.

(c) Find its perimeter.

27. A tank contains 120 litres. A small tap empties it at x litres per minute. A large tap empties it at (x + 2) litres per minute. The small tap takes 10 minutes longer.

(a) Form an equation in x.

(b) Find the small tap's rate.

(c) Find the time taken by the small tap.

28. A group shares a bill of $180 equally. If three more people join the group, each person pays $3 less.

(a) Let n be the original number of people. Form an equation.

(b) Find the original number of people.

(c) Find each original person's payment.

29. The equation $x^2-7x+10=0$ has roots p and q, with p < q.

(a) Find p and q.

(b) Write a monic quadratic equation with roots p + 2 and q + 2.

(c) Find p^2+q^2.

30. A rectangular photograph has width x cm and length (x + 3) cm. A border 2 cm wide surrounds it on all four sides. The total area of the photograph and border is 180 cm².

(a) Form an equation in x.

(b) Find the photograph's dimensions.

(c) Find the area of the border.

Final Answers

1. $3p^2-12pq+10q^2$

2. $2x(x-4)(x+4)$

3. 219

4. $4x-6$

8118

5. $(x-3)(x+5)$

6. $(2x-3)(3x+2)$

Final Answers

7. $4(m+2n)^2$

8. $(2a-b)(3c-2d)$

9. $(x+2)(x+6)$

10. $(x+2)(x-7)(x+7)$

11. $\frac{6}{5b}$

12. $\frac{2(2x-y)}{(x-3)(x+3)}$

$2x+y\neq 0;\ x\neq 3;\ x\neq -3.$

Final Answers

13. $\frac{31x-24}{20}$

14. $\frac{-2x+3}{(x-4)^2}$

$x \neq 4$

15. 1

$x \neq -2, -5, 2$

16. $x=3$ or $x=\frac{-4}{3}$

$x \neq 2, -2$

17. x is not a factor of the entire denominator. The original expression is already in simplest form: $\frac{x^2+3x}{2x+1}$.

18. $x=4$ or $x=-2$

Final Answers

19. $x=\frac{3}{2}$ or $x=\frac{-2}{3}$

20. (a) 73

(b) 65

21. (a) $(6,0)$

(b) $x=3$

(c) $(3,9)$

(d) 27 square units

22. (a) $(-3,0)$ and $(5,0)$

(b) -15

(c) $(1,-16)$

(d) $x=1$

23. (a) $5,\ 0,\ -3,\ -4,\ -3,\ 0,\ 5$

(b) $(1,-4)$; $x=1$; see final graph.

24. (a) b = -4; c = -3.

(b) $y=(x-2)^2-7$

(c) -3

Final Answers

25. (a) $(2,4)$ and $(5,25)$

(b) $x=2$ or $x=5$

(c) $2<x<5$

26. (a) $x(x+3)=54$

(b) Width 6 cm; length 9 cm.

(c) 30 cm

27. (a) $\frac{120}{x}-\frac{120}{x+2}=10$

(b) $x=4$ litres per minute

(c) 30 minutes

28. (a) $\frac{180}{n}-\frac{180}{n+3}=3$

(b) 12 people

(c) $15

29. (a) p = 2; q = 5.

(b) $x^2-11x+28=0$

(c) 29

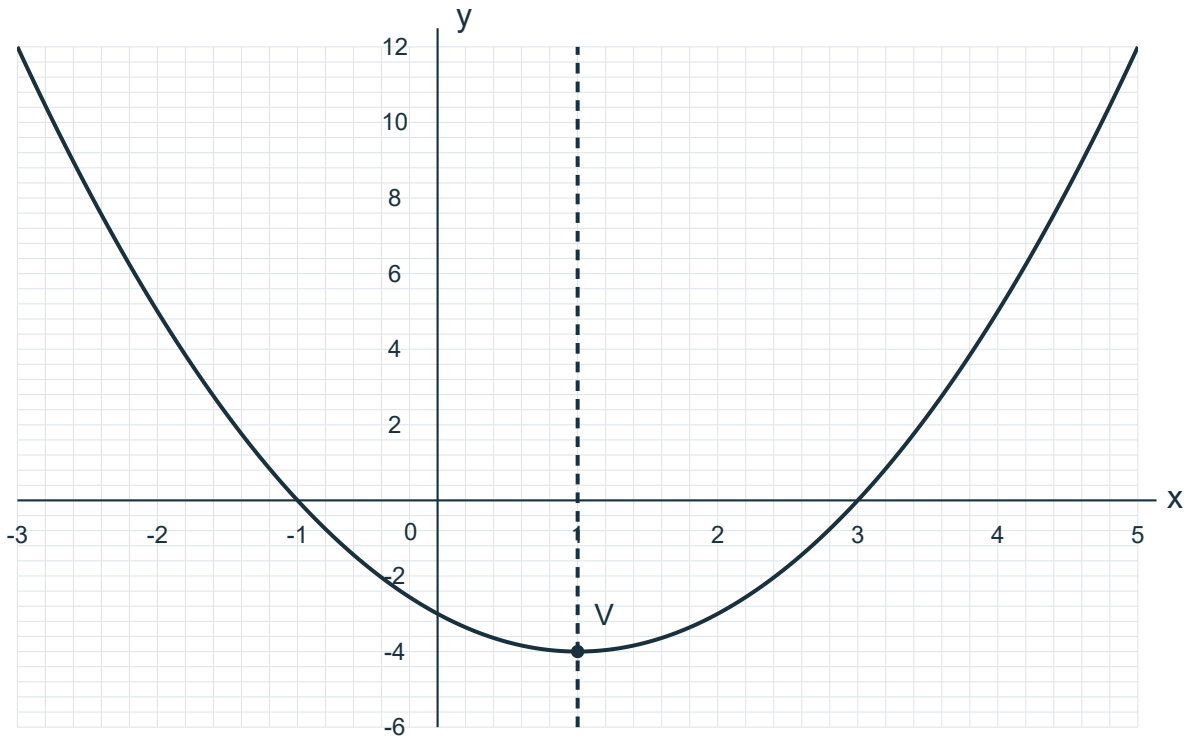
30. (a) $(x+4)(x+7)=180$

(b) 8 cm by 11 cm

(c) 92 cm²

Final Answers

Question 23: Final graph



Use the numbered scale on each axis.