S2 Mathematics Practice Paper: Algebraic Expressions and Factorisation, Linear Equations and Inequalities, Percentages and Ratio, Area and Volume, Statistical Charts and Probability

Level: S2 | Subject: Mathematics | 60 minutes | 100 marks | 24 questions | answer key

Section A: Algebraic Expressions and Factorisation (18 marks)

Show all working steps and give suitable units in your answers.

#	Question	Answer	Marks
1	Expand and simplify (3x - 2)(2x + 5) - 4x(x - 1), and state the coefficient of x^2, the coefficient of x and the constant term.	Expand: (3x - 2)(2x + 5) = $6x^2$ + 11x - 10 and 4x(x - 1) = $4x^2$ - 4x. Subtracting gives $2x^2$ + 15x - 10, so the coefficient of x^2 is 2, the coefficient of x is 15 and the constant term is -10.	5
2	Factorise each of the following: (a) $6x^2$ - 9x (b) x^2 - 7x + 12 (c) $4x^2$ - 25	(a) $6x^2$ - 9x = 3x(2x - 3) taking out the common factor 3x; (b) x^2 - 7x + 12 = (x - 3)(x - 4) since -3 + -4 = -7 and -3 × -4 = 12; (c) $4x^2$ - 25 is a difference of two squares, so it equals (2x - 5)(2x + 5).	5
3	Factorise $2x^2$ + 7x + 3, and factorise x^2 + 10x + 25 using the perfect square formula.	$2x^2$ + 7x + 3 = (2x + 1)(x + 3), checked by cross-multiplication 2x × 3 + 1 × x = 7x; x^2 + 10x + 25 = $(x + 5)^2$ because 5^2 = 25 and 2 × 5 = 10.	4
4	Simplify (x^2 - 9) / (x^2 + x - 12) and state the values that x cannot take.	x^2 - 9 = (x - 3)(x + 3) and x^2 + x - 12 = (x + 4)(x - 3). Cancelling the common factor (x - 3) gives (x + 3) / (x + 4), where $x \neq 3$ and $x \neq -4$.	4

Section B: Linear Equations and Inequalities (17 marks)

Show all working steps and give suitable units in your answers.

#	Question	Answer	Marks
5	Solve the equation 5(x - 3) = 2x + 9.	Expanding the left side gives 5x - 15 = 2x + 9, so 3x = 24 and x = 8. Check: 5(8 - 3) = 25 and 2 × 8 + 9 = 25, so both sides agree.	5
6	Solve the equation (x + 1)/2 - (x - 3)/3 = 2.	Multiply both sides by 6: 3(x + 1) - 2(x - 3) = 12, which gives 3x + 3 - 2x + 6 = 12, so x + 9 = 12 and x = 3. Check: 4/2 - 0/3 = 2.	4
7	Solve the inequality 3 - 2x < 11 and state the smallest integer solution.	From 3 - 2x < 11 we get -2x < 8; dividing both sides by -2 reverses the sign, giving x > -4. Hence the smallest integer solution is -3, since -3 > -4.	4
8	The sum of three consecutive integers is 87. Find the three integers.	Let the smallest integer be n, then n + (n + 1) + (n + 2) = 87, so 3n + 3 = 87, 3n = 84 and n = 28. The integers are 28, 29 and 30, and 28 + 29 + 30 = 87.	4

Section C: Percentages and Ratio (17 marks)

Show all working steps and give suitable units in your answers.

#	Question	Answer	Marks

9	The price of a toy is reduced from \$480 to \$420. Find the percentage decrease, correct to 0.1%.	The reduction is 480 - 420 = \$60. Percentage decrease = 60 ÷ 480 × 100% = 12.5%, so the price falls by 12.5%.	5
10	An item costs \$250. The shopkeeper marks it up by 40% and later sells it at a 15% discount. Find the selling price and the percentage profit.	Marked price = 250 × 1.4 = \$350; selling price = 350 × 0.85 = \$297.5. Profit = 297.5 - 250 = \$47.5, so the percentage profit = 47.5 ÷ 250 × 100% = 19%.	4
11	\$756 is shared among A, B and C in the ratio 2 : 3 : 4. Find the amount each receives.	Total number of parts = 2 + 3 + 4 = 9, so one part = 756 ÷ 9 = \$84. A gets 2 × 84 = \$168, B gets 3 × 84 = \$252 and C gets 4 × 84 = \$336, which totals \$756.	4
12	8 workers need 12 days to finish a job. If the number of workers is reduced to 6 with the same efficiency, how many days are needed?	The amount of work is fixed, so the number of workers is inversely proportional to the number of days. Total work = 8 × 12 = 96 worker-days, so 6 workers need 96 ÷ 6 = 16 days, which is 4 days more.	4

Section D: Area and Volume (16 marks)

Show all working steps and give suitable units in your answers.

#	Question	Answer	Marks
13	A circle has radius 7 cm. Taking π = 22/7, find its area and circumference.	Area = πr^2 = (22/7) × 7 × 7 = 154 cm^2; circumference = 2πr = 2 × (22/7) × 7 = 44 cm.	4
14	A cylinder has radius 3 cm and height 10 cm. Find its volume and total surface area in terms of π.	Volume = $\pi r^2 h$ = π × 3^2 × 10 = 90π cm^3; total surface area = $2\pi r^2 + 2\pi rh$ = 18π + 60π = 78π cm^2.	4
15	A cone has radius 6 cm and height 8 cm. Find its slant height, volume and curved surface area in terms of π.	Slant height l = $\sqrt{(6^2 + 8^2)}$ = 10 cm; volume = $(1/3)\pi r^2 h$ = (1/3)π × 36 × 8 = 96π cm^3; curved surface area = πrl = π × 6 × 10 = 60π cm^2.	4
16	Two similar triangles have areas in the ratio 9 : 25. If the smaller triangle has perimeter 24 cm, find the perimeter of the larger triangle and the ratio of corresponding sides.	For similar figures the ratio of areas equals the square of the ratio of corresponding sides, so sides are in the ratio $\sqrt{9} : \sqrt{25}$ = 3 : 5. Perimeters follow the same ratio, so the larger perimeter = 24 × 5/3 = 40 cm.	4

Section E: Statistical Charts (16 marks)

Show all working steps and give suitable units in your answers.

#	Question	Answer	Marks
17	Find the mean, median and mode of the data: 12, 15, 15, 18, 20, 25.	Sum = 105 and there are 6 values, so the mean = 105 ÷ 6 = 17.5. The middle two values are 15 and 18, so the median = 16.5. The value 15 occurs most often, so the mode = 15.	4
18	The test marks of 30 students are grouped as follows: 0-9 has 4 students, 10-19 has 8, 20-29 has 12 and 30-39 has 6. Estimate the mean mark using class mid-values, correct to 1 decimal place.	The class mid-values are 4.5, 14.5, 24.5 and 34.5. Weighted total = 4×4.5 + 8×14.5 + 12×24.5 + 6×34.5 = 18 + 116 + 294 + 207 = 635, so the estimated mean ≈ 635 ÷ 30 = 21.2 marks.	4
19	Of 120 students, 45 like football best. In a pie chart, what is the angle of the sector	The fraction is 45 ÷ 120 = 0.375, so the sector angle = 0.375 × 360° = 135°, which is	4

	representing football?	37.5% of the whole pie chart.	
20	In a class of 40, favourite sports are basketball 12, football 10, badminton 8 and others 10. Find the percentage for each category.	Basketball = 12/40 = 30%, football = 10/40 = 25%, badminton = 8/40 = 20% and others = 10/40 = 25%, and 30 + 25 + 20 + 25 = 100%.	4

Section F: Probability (16 marks)

Show all working steps and give suitable units in your answers.

#	Question	Answer	Marks
21	Two fair dice are thrown together. Find the probability that the sum of the two numbers is 7.	There are 6 × 6 = 36 equally likely outcomes. Six of them give a sum of 7, namely (1,6), (2,5), (3,4), (4,3), (5,2) and (6,1), so the probability = 6/36 = 1/6.	4
22	A bag contains 5 red, 3 blue and 2 green balls. One ball is drawn at random. Find the probability that it is not red.	There are 5 + 3 + 2 = 10 balls in total and 3 + 2 = 5 of them are not red, so the probability = 5/10 = 1/2.	4
23	Using the bag in the previous question, one ball is drawn and not replaced, then a second ball is drawn. Find the probability that both balls are red.	The first ball is red with probability 5/10 = 1/2. Then 4 red balls remain among 9 balls, so the second is red with probability 4/9, giving a probability of 1/2 × 4/9 = 2/9.	4
24	Three fair coins are tossed together. Find the probability of getting at least one head.	There are $2^3 = 8$ equally likely outcomes and only the outcome with three tails has no head, so the probability of at least one head = 1 - 1/8 = 7/8.	4