ESSENTIAL

SQA EXAM PRACTICE

NATIONAL 5

MATHEMATICS

Practice Questions & Exam Papers

QUESTIONS & PAPERS

Practise 160+ questions covering every topic

Complete 2 practice papers that mirror the real SQA exams

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HODDER GIBSON
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Practice Questions

The skills and subskills are shown in the Key Skills index grid below. The grid also shows the Practice Questions (PQ) which deal with each subskill. You can use this grid if you want to focus on practising a particular topic.

Algebraic skills		**Geometric skills**	
Subskill	**PQ**	**Subskill**	**PQ**
Expanding brackets and simplifying	1–10	Arcs and sectors	1–6
Factorising and completing the square	11–20	Volume of standard and composite solids	7–10
Algebraic fractions	21–30	Applying Pythagoras' theorem	11–17
Find / interpret the equation of a straight line	31–35	Circles and polygons	18–20
Solve linear equations and inequations	36–43	Similarity	21–25
Solve simultaneous equations	44–49	2D and 3D vectors	26–30
Change the subject of a formula	50–55		
Quadratic function: graphs	56–60		
Quadratic equations; factorising, using the formula and the discriminant	61–70		
Trigonometric skills		**Statistical and numerical skills**	
Subskill	**PQ**	**Subskill**	**PQ**
Graphs of trigonometric functions	1–4	Surds	1–6
Trig equations and identities	5–11	Indices	7–14
Area of a triangle using trigonometry	12–14	Percentages	15–24
Sine and cosine rules	15–21	Fractions and mixed numbers	25–30
Using bearings with trigonometry	22–27	Standard deviation and interquartile range	31–35
		Scattergraphs	36, 37

Practice Papers

This Key Skills index grid shows the questions in the Practice Papers which deal with each subskill. You can use this grid if you want to do a whole or a part of a Practice Paper.

		Practice Paper			
Skill	**Subskill**	**A1**	**A2**	**B1**	**B2**
Algebraic	Manipulate algebraic expressions	2		2	
	Brackets	4		4	
	Factorising	7		6	
	Change subject	14			
		16			
	Algebraic fractions	10		9	
				16	
	Straight line	15	14	13	2
				17	
	Equations and inequations	3		8	
		11		14	
	Quadratic functions	8	4		
	Quadratic equations	6			5
		13			
Geometric	Use of formulae		6	7	3
	Arcs / sectors		11		7
	Pythagoras in circle				13
	Volume				
	Pythagoras' theorem		12	5	15
	Properties of circles / polygons				13
	Similarity				9
	Vectors	5	3	15	11
		12			
Trigonometric	Trig graphs, identities, and equations	17	10	12	4
		18	15		10
	Non right-angled triangles		5	11	8
	Area		8		14
	Sine / cosine rules		13		16
	Bearings				
Statistical and Numerical	Surds and indices	5	2	3	1
		9		5	
				10	
	Percentages		1		12
			7		
	Decimals and fractions	1		1	
	Analyse data		9		6
	Mean and standard deviation				
	Semi-interquartile range				
	Scattergraph / line of best fit		14		

Algebraic skills

HOW TO ANSWER

Expanding brackets and simplifying

Expand $(2x + 3)(3x^2 + 4x - 2)$.

$$2x(3x^2 + 4x - 2) + 3(3x^2 + 4x - 2) = 6x^3 + 8x^2 - 4x + 9x^2 + 12x - 6$$
$$= 6x^3 + 17x^2 + 8x - 6$$

Top Tip!

For this type of question, split the two-term bracket then multiply the second bracket by each of these terms.

		MARKS
1	Expand and simplify $(3x + 2)(3x - 5)$.	**2**
2	Expand and simplify $(3x - 2)(2x + 5)$.	**2**
3	Expand and simplify $(4k - y)(3k + 5y)$.	**2**
4	Expand and simplify $4(3x - 1) - 5(2x + 3)$.	**3**
5	Expand and simplify $(3x - 5)^2$.	**2**
6	Expand and simplify $(3x + 2)^2 + 5(3x - 2)$.	**3**
7	Expand and simplify $(3x - 2)(4x + 1) + 2(3x^2 + 1)$.	**3**
8	Expand and simplify $(2x + 3)(2x^2 + 3x + 1)$.	**3**
9	Expand and simplify $(3x - 2)(4x^2 + 5x - 3)$.	**3**
10	Expand and simplify $(4x^2 - 2x + 5)(3x - 2)$.	**3**

HOW TO ANSWER

Factorising and completing the square

Factorise $8x^2 - 50$.

$$8x^2 - 50 = 2(4x^2 - 25)$$
$$= 2[(2x)^2 - 5^2]$$
$$= 2(2x - 5)(2x + 5)$$

Top Tip!

Take out common factor.

Set up as difference of two squares.

		MARKS
11	Factorise $3x^2 - 18x$.	**2**
12	Factorise $6x^2 - 9x$.	**2**
13	Factorise $x^2 - 64$.	**1**
14	Factorise $9a^2 - 4b^2$.	**2**
15	Factorise $x^2 + 8x + 15$.	**2**
16	Factorise $x^2 - 3x - 4$.	**2**
17	Factorise $3x^2 - 11x - 4$.	**2**
18	Factorise $6x^2 - 11x - 10$.	**2**
19	Express $x^2 + 8x + 12$ in the form $(x + a)^2 + b$.	**3**
20	Express $x^2 - 4x + 1$ in the form $(x - a)^2 - b$.	**3**

HOW TO ANSWER

Quadratic equations: factorising, using the formula and the discriminant

Determine the nature of the roots of the equation $2x^2 - 3x - 1 = 0$.

$2x^2 - 3x - 1$

$a = 2, b = -3, c = -1$

$b^2 - 4ac = (-3)^2 - 4(2)(-1)$

$= 9 + 8 = 17$

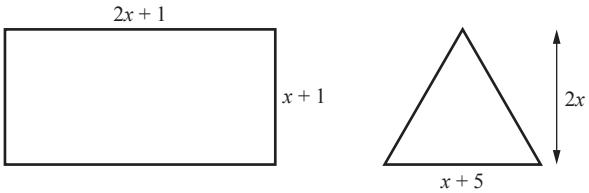
$17 > 0$

Therefore, there are two real, distinct, roots.

Top Tip!

Use the discriminant $b^2 - 4ac$ and then compare with > 0, $= 0$ and < 0.

		MARKS
61	Solve the equation $x^2 + x - 6 = 0$.	**2**
62	Solve the equation $2x^2 + 7x - 15 = 0$.	**3**
63	Solve the equation $2w^2 - w - 10 = 0$.	**3**
64	The diagrams show a rectangle and a triangle. All measurements are in centimetres.	



a)	Find an expression for the area of the rectangle.	**1**
b)	Given that the area of the rectangle is **equal** to the area of the triangle, show that $x^2 - 2x + 1 = 0$.	**2**
c)	Hence find, algebraically, the length and width of the rectangle.	**3**
65	Determine the nature of the roots of the equation $f(x) = 2x^2 + 4x + 3$.	**3**
66	Determine the nature of the roots of the function $f(x) = 6x^2 + 5x - 1$.	**3**
67	Determine the nature of the roots of the function $f(x) = x^2 + 6x + 9$.	**3**
68	Solve the equation $2x^2 + 5x - 4 = 0$. **Give your answer correct to 1 decimal place.**	**3**
69	Find the two roots of the equation $2x^2 - 3x - 4 = 0$. **Give your answer correct to 1 decimal place.**	**3**
70	Solve the equation $x^2 + 2x - 6 = 0$. **Give your answer correct to 2 significant figures.**	**4**

Paper 1 (non-calculator)

Duration: 1 hour 15 minutes

Total marks: 50

Attempt ALL questions.

You may NOT use a calculator.

Full credit will be given only to solutions which contain appropriate working.

State the units for your answer where appropriate.

Write your answers clearly in the spaces provided in this booklet. Additional space for answers is provided at the end of this booklet. If you use this space you must clearly identify the question number you are attempting.

Use **blue** or **black** ink.

Before leaving the examination room you must give this booklet to the Invigilator; if you do not, you may lose all the marks for this paper.

MARKS

1 Evaluate $2\frac{1}{4} \div \frac{5}{6}$. **2**

2 Expand and simplify **3**
$(3x - 2)(x^2 - 3x + 1)$.

3 A is the point (1, 3, 2). **2**

$\overrightarrow{AB}$ is $\begin{pmatrix} 4 \\ 1 \\ -3 \end{pmatrix}$

Write down AB the coordinates of B.

4 Factorise fully **2**
$3k^2 - 12$.

5 Two forces acting on an object are represented by vectors **a** and **b**. **3**

$\mathbf{a} = \begin{pmatrix} 2 \\ -1 \\ -1 \end{pmatrix}$ $\mathbf{b} = \begin{pmatrix} 6 \\ 3 \\ -1 \end{pmatrix}$

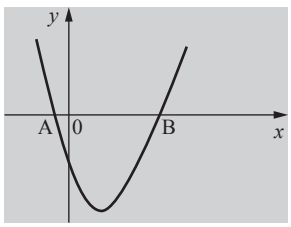
Calculate $|\mathbf{a} + \mathbf{b}|$, the magnitude of the resultant force.

Express your answer as a surd in its simplest form.

6 Prove that the roots of the equation $2x^2 + 5x - 3 = 0$ are real and rational. **3**

7 Write $x^2 + 6x - 5$ in the form $(x + p)^2 + q$. **2**

8 The diagram shows part of the graph of $y = x^2 - 6x - 7$.
A is the point (−1, 0) and B is the point (7, 0).



a) State the equation of the axis of symmetry of the graph. **2**

b) Hence, or otherwise, find the minimum value of $y = x^2 - 6x - 7$. **2**

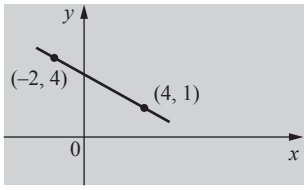
Paper 2

Duration: 1 hour 50 minutes
Total marks: 60
Attempt ALL questions.
You may use a calculator.
Full credit will be given only to solutions which contain appropriate working.
State the units for your answer where appropriate.
Write your answers clearly in the spaces provided in this booklet. Additional space for answers is provided at the end of this booklet. If you use this space you must clearly identify the question number you are attempting.
Use **blue** or **black** ink.
Before leaving the examination room you must give this booklet to the Invigilator; if you do not, you may lose all the marks for this paper.

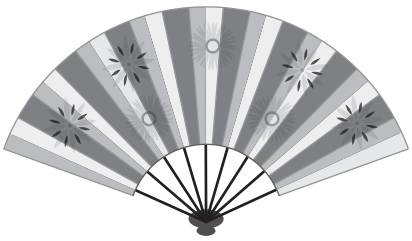
MARKS

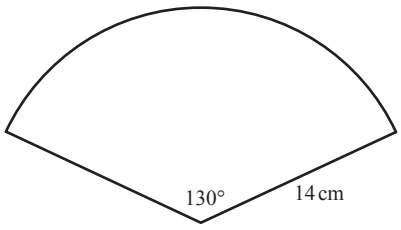
1 A light year, the distance light travels in one year, is approximately $5{\cdot}88 \times 10^{12}$ miles. **3**
There are approximately $3{\cdot}15 \times 10^{7}$ seconds in one year.
How far does light travel in one second?
Give your answer in scientific notation, correct to 3 significant figures.

2 Find the equation of the line shown in the diagram. **3**



3 A fan is in the shape of a sector of a circle, as shown. **4**
The radius is 14 centimetres.
The angle at the centre is 130°.
Calculate the perimeter of the fan.





4 Show that **2**

$$\frac{\sin^2 x°}{(1-\sin^2 x°)} = \tan^2 x°.$$

5 Solve the equation **4**
$2x^{2\circ} - 3x° - 7 = 0$.
Give your answer correct to 2 significant figures.

Practice Paper A

Paper 1 (non-calculator)

Question	Expected answer	Mark	Commentary with hints and tips	Demand
1	$\frac{9}{4} \div \frac{5}{6}$ $= \frac{9}{4} \times \frac{6}{5}$ ✓ $= \frac{54}{20}$ $= \frac{27}{10}$ ✓	**2**	Write mixed number as improper fraction. To divide, invert fraction and multiply. Solution (does not simplify further).	C
2	$(3x - 2)(x^2 - 3x + 1)$ $= 3x(x^2 - 3x + 1) - 2(x^2 - 3x + 1)$ ✓ $= 3x^3 - 9x^2 + 3x - 2x^2 + 6x - 2$ ✓ $= 3x^3 - 11x^2 + 9x - 2$ ✓	**3**	Split first bracket. Cannot use FOIL as there are three terms in second bracket. Multiply out brackets. Collect like terms.	C
3	$\begin{pmatrix} 1 \\ 3 \\ 2 \end{pmatrix} + \begin{pmatrix} 4 \\ 1 \\ -3 \end{pmatrix} = \begin{pmatrix} 5 \\ 4 \\ -1 \end{pmatrix}$ ✓ B(5, 4, −1) ✓	**2**	Use vector. State in coordinate form.	C
4	$3k^2 - 12$ $= 3(k^2 - 4)$ ✓ $= 3(k^2 - 2^2)$ $= 3(k - 2)(k + 2)$ ✓	**2**	Take out common factor. Identify difference of two squares. Factorise fully. When factorising check for: • common factor • difference of two squares • trinomial / quadratic.	> C
5	$\mathbf{a} + \mathbf{b} = \begin{pmatrix} 8 \\ 2 \\ -2 \end{pmatrix}$ $\lvert \mathbf{a} + \mathbf{b} \rvert^2 = 64 + 4 + 4$ ✓ $= 72$ $\lvert \mathbf{a} + \mathbf{b} \rvert = \sqrt{72}$ ✓ $= 6\sqrt{2}$ ✓	**3**	Use Pythagoras in 3D to find $\lvert \mathbf{a} + \mathbf{b} \rvert^2$. Take the square root to find the magnitude. Simplify the surd.	C
6	$b^2 - 4ac$ $= 5^2 - 4(2)(-3)$ ✓ $= 49$ ✓ $49 > 0$ AND perfect square. Therefore two real, distinct and rational roots ✓	**3**	Use the discriminant. Correctly substitute a, b, c. Interpret result. Reminder: • $b^2 - 4ac = 0$: equal roots • $b^2 - 4ac > 0$: two real distinct roots • $b^2 - 4ac < 0$: no real roots.	C
7	$x^2 + 6x - 5$ $(x + 3)^2 - 5 - 9$ ✓ $(x + 3)^2 - 14$ ✓	**2**	$\frac{1}{2}$ of x coefficient. Complete solution.	C