# Mathematics – Linear
# Higher Tier
# 90 Minutes

| For examiner use only | | |
|---|---|---|
| Maximum mark | Mark awarded | % achieved |
| 75 | | |

**CALCULATORS ARE <u>NOT</u> TO BE USED FOR THIS PAPER**

**INSTRUCTIONS TO CANDIDATES**

Use black ink or black ball-point pen

Answer <u>all</u> the questions in the spaces provided

Take π as 3.14

**INFORMATION FOR CANDIDATES**

You should give details of your method of solution when appropriate

Unless stated diagrams are not drawn to scale

Scale drawing solutions will not be acceptable where you are asked to calculate

The number of marks is given in brackets at the end of each question or part-question

| | |
|---|---|
| STUDENT NAME: | |
| NATIONALITY: | |
| DATE OF TEST: | |
| LOCATION OF TEST: | |
| ADMINISTERED UNDER EXAMINATION CONDITIONS BY: *(Please state your full name and position)* | |

**STUDENT DECLARATION:**

I declare that I completed the entrance test under exam conditions and without any use of unauthorised materials. I confirm that all the submitted answers are my own work.

STUDENT SIGNATURE: _____DATE:_____

**INVIGILATOR DECLARATION:**

I declare that the above named student was fully supervised during the test. The assessment was completed under strict exam conditions and in the time allowed, in accordance with the instructions on the test paper.

INVIGILATOR SIGNATURE:_____DATE:_____

## Formula List

**Area of trapezium** $= \frac{1}{2}(a+b)h$
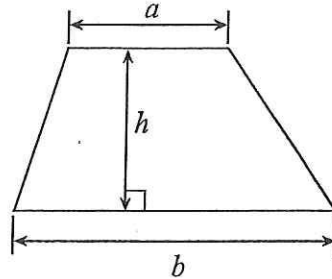
**Volume of prism** = area of cross-section × length
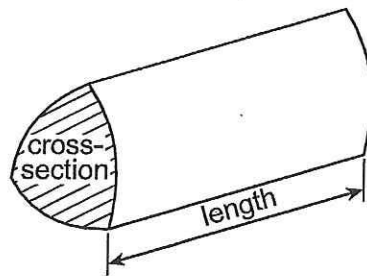
**Volume of sphere** $= \frac{4}{3}\pi r^3$

**Surface area of sphere** $= 4\pi r^2$
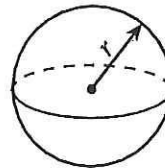
**Volume of cone** $= \frac{1}{3}\pi r^2 h$

**Curved surface area of cone** $= \pi r l$
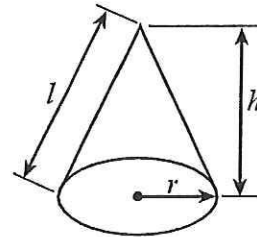
**In any triangle** $ABC$

**Sine rule** $\dfrac{a}{\sin A} = \dfrac{b}{\sin B} = \dfrac{c}{\sin C}$

**Cosine rule** $a^2 = b^2 + c^2 - 2bc \cos A$

**Area of triangle** $= \frac{1}{2}ab \sin C$
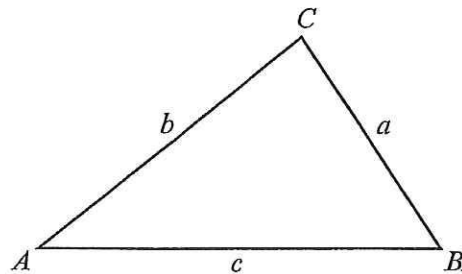
**The Quadratic Equation**

The solutions of $ax^2 + bx + c = 0$

where $a \neq 0$ are given by

$$x = \frac{-b \pm \sqrt{(b^2 - 4ac)}}{2a}$$

1.

(a)  The cost of a stand season ticket last year was £200. This year it has increased to £250. Find the percentage increase in the cost of the stand season ticket.

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[3]

(b)  Two friends, Nigel and Paul, decide to share the cost of a £100 field season ticket in the ratio 4:1.

(i)  How much **each** should each of Nigel and Paul pay towards the cost of the ticket?

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Nigel pays ..................................................          Paul pays ..................................................

[1]

**2.**  Simplify $3(a + 2b) + 7a - 8b$.

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[1]

3.

Express $0 \cdot 6\dot{4}\dot{2}$ as a fraction.

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---------------------------------------------------------------------------------------------------------------[3]

4.

The diagram shows a trapezium.

$(2x - 3)\,\text{cm}$

$(4x + 6)\,\text{cm}$

Area = $70\ \text{cm}^2$
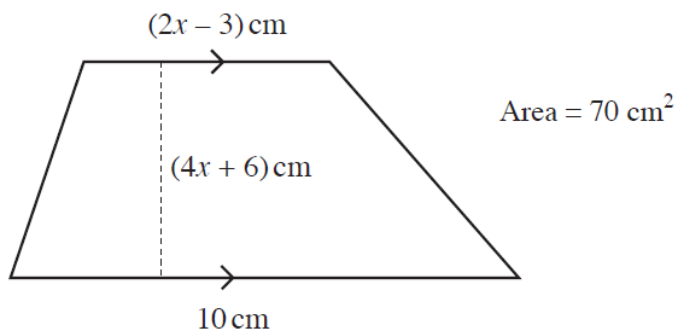
10 cm

*Diagram not drawn to scale.*

The parallel sides of a trapezium are of lengths 10 cm and $(2x - 3)$ cm. The height of the trapezium is $(4x + 6)$ cm and its area is $70\ \text{cm}^2$.

*(a)* Show that $4x^2 + 20x - 49 = 0$.

[3]

Use the quadratic formula to find an approximate answer to the equation

[3]

5.

The table shows some of the values of $y = x^3 + 3$ for values of $x$ from $-3$ to $3$.

(a)   Complete the table by finding the value of $y$ for $x = -1$ and $x = 2$.

| $x$ | $-3$ | $-2$ | $-1$ | 0 | 1 | 2 | 3 |
|---|---|---|---|---|---|---|---|
| $y = x^3 + 3$ | $-24$ | $-5$ | | 3 | 4 | | 30 |

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[2]

(b)   On the graph paper below, draw the graph of $y = x^3 + 3$ for values of $x$ from $-3$ to $3$.

[2]
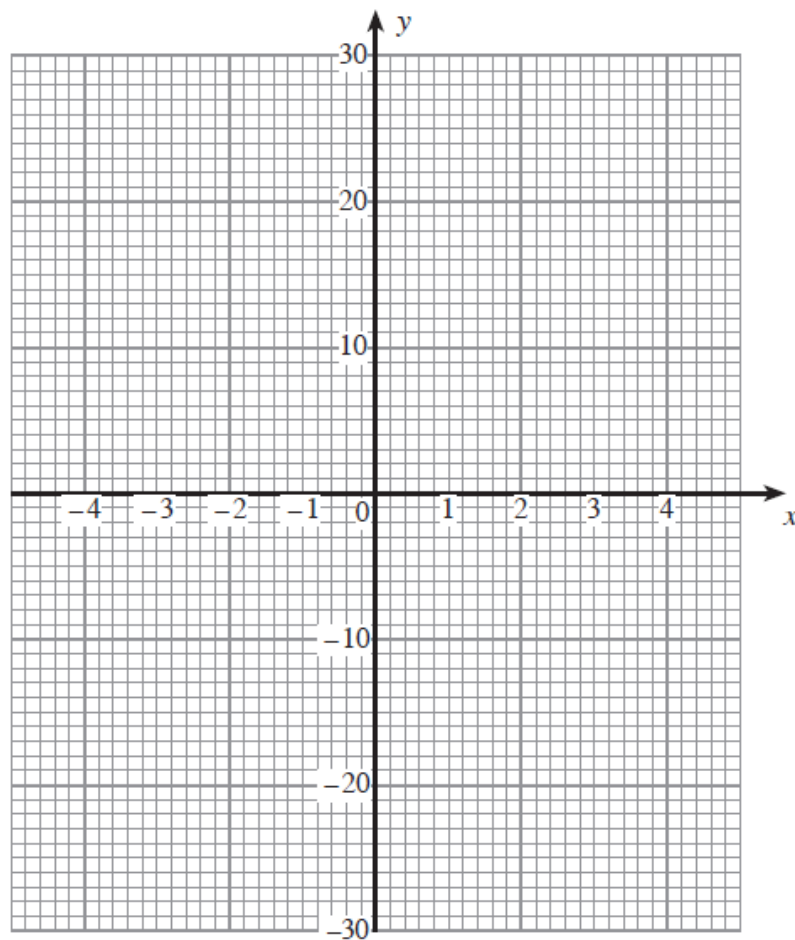
6.

(a)  Express 360 as a product of prime numbers in index form.

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[3]

(b)  Explain why $2^5 \times 3^4$ is **not** a perfect square.

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[1]

7.

(a)  Simplify $\left(\sqrt{8}\right)^2$.

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[1]

(b)  Express $\dfrac{2}{9}$ as a recurring decimal.

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[1]

Evaluate

(i)  $2^{-2}$,

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(ii)  $7^0$.

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[2]

8.

Write down the equation of the straight line shown in the following diagram in the form $y = mx + c$.

[3]

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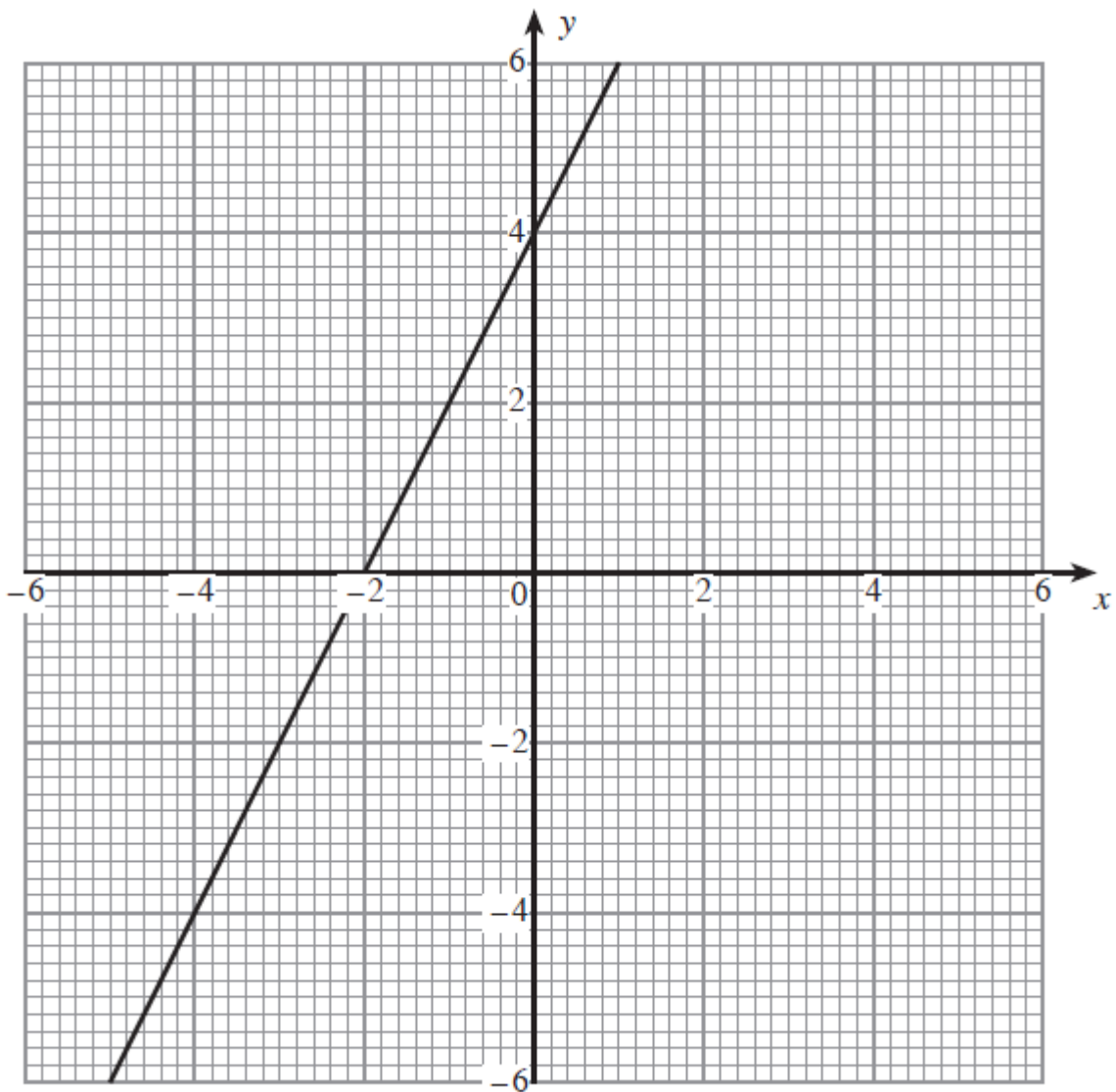
9.

Triangles $LMN$ and $PQR$ are similar, with $L\hat{M}N = P\hat{Q}R$, $M\hat{N}L = Q\hat{R}P$, $LM = 4$ cm, $MN = 3\cdot2$ cm, $PR = 4\cdot5$ cm and $PQ = 6$ cm.
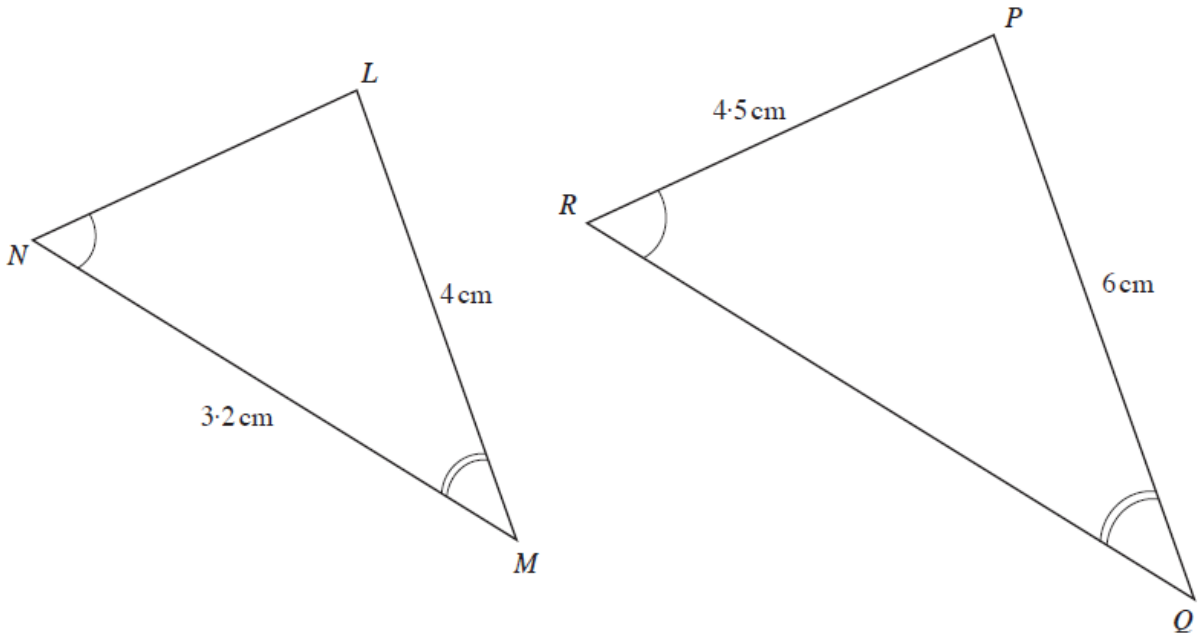


*Diagrams not drawn to scale.*

Showing all your working, find the length of

(a)   $RQ$,

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[2]

(b)   $LN$.

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[2]

10.

Expand the following expression, simplifying your answer as far as possible.

$$(x + 8)(x - 2)$$

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[2]

11.

Solve the following simultaneous equations by an algebraic (not graphical) method.
Show all your working.

$$7x + 5y = 20$$
$$2x - 3y = 19$$

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[4]

12.

Make $k$ the subject of the formula

$$5(2k - m) = ck + 5.$$

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[4]

13.
(a) Solve $8x + 4 = 7 - 4x$.

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[3]

(b) Solve $5(2x - 3) = 50$.

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[3]

(c) (i) Factorise $2x^2 - 6x$.

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(ii) Factorise $3a - 12$.

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[3]

(d) Write down the first three terms of a sequence where the $n$th term is $n^2 - 3$.

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[2]

**14.**

(a)   Evaluate $\dfrac{2\cdot3 \times 4\cdot6}{5\cdot8 - 3\cdot6}$ correct to one decimal place.

[2]

(b)   Evaluate $\dfrac{1}{4} \div \dfrac{1}{3}$.

[1]

(c)

The length of a plank of wood is 950 mm, measured to the nearest 10 mm.
Write down the **least** and **greatest** possible values of the length of the plank.

Least value ...................... mm          Greatest value ...................... mm          [2]

**15.**

(a)   Factorise the expression $x^2 - 9x - 10$ and hence solve the equation $x^2 - 9x - 10 = 0$.

[3]

*(b)*

Solve the following equation. [4]

$$\frac{20 + 3x}{4} + \frac{5 - x}{5} = \frac{13}{4}$$

*(c)* Simplify $3x^6 y^2 \times 4x^2 y^5$.

[2]

*(d)* Factorise $x^2 - 9$.

[1]

16.

(a) Write **each** of the following numbers in standard form.

(i) 6 million

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(ii) 0·0043

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[2]

(b) Find, in standard form, the value of $(8·4 \times 10^3) \times (2 \times 10^5)$.

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[2]

17.

A cylinder has a radius of 5 cm and a volume of 2800 cm$^3$. Find the height of the cylinder. Give your answer to an appropriate degree of accuracy.
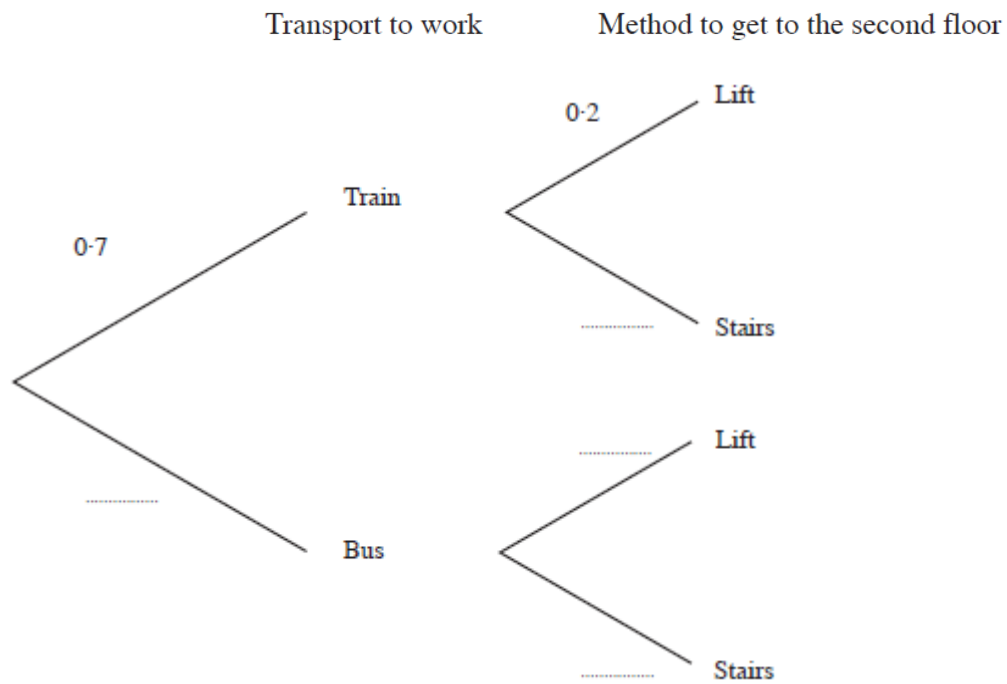
Take PI = 22/7

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[3]

17.

Jayne works in a second floor office, she can either take the train or bus to work. The probability that she takes the train to work is 0·7. When Jayne arrives at the office building where she works she can either use the stairs or the lift to the second floor. The probability that she uses the lift is 0·2.

(a)  Complete the following tree diagram.                                                  [2]

Transport to work                    Method to get to the second floor

0·2                Lift

Train

0·7

........................ Stairs

Lift

........................

........................

Bus

........................ Stairs

(b)  Calculate the probability that Jayne takes the train to work and uses the stairs to get to her office.

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[2]