UNIVERSITY ACADEMY
HOLBEACH

UNIVERSITY OF
LINCOLN

A Level Mathematics Information

& Summer Preparation Booklet.

Contents

SECTION 1 – NUMBER

1. $\frac{3}{4}+\frac{1}{3}$

2. $5\frac{1}{3}-\frac{3}{2}$

3. $2\frac{2}{3}\times\frac{1}{4}$

4. $5\frac{1}{3}\div 2\frac{1}{4}$

5. Simplify: (a) $\sqrt{18}$ (b) $\sqrt{48}$

6. Simplify: (a) $\sqrt{6}\times\sqrt{15}$ (b) $\sqrt{10}\times\sqrt{15}$

7. Simplify: (a) $\sqrt{27}+\sqrt{12}$ (b) $\sqrt{125}-\sqrt{75}$

8. Simplify: (a) $\frac{10}{\sqrt{5}}$ (b) $\frac{\sqrt{5}}{\sqrt{3}}$ (c) $\frac{2\sqrt{3}+5}{\sqrt{3}}$ (d) $\frac{2\sqrt{15}}{\sqrt{12}}$ (e) $\frac{12\sqrt{3}-6\sqrt{2}}{\sqrt{6}}$

9. Expand brackets and simplify (a) $(\sqrt{5}-2)(2\sqrt{5}-1)$
   (b) $(3\sqrt{5}-\sqrt{7})^2$ (c) $(2\sqrt{11}-3\sqrt{6})(2\sqrt{11}+3\sqrt{6})$

10. (a) Show that $x=1+\sqrt{5}$ is a solution of the quadratic equation $x^2-2x-4=0$.
    (b) A right-angled triangle has the two shorter sides $\sqrt{3}-1$ and $\sqrt{3}+1$. Show that the hypotenuse has length $2\sqrt{2}$.
    (c) A rectangle has two sides $\sqrt{7}-1$ and $x\sqrt{7}+2$. Its area is 12 square units. Show that $x=2$.

11. Express the following in their simplest form.
    (a) $9^{1/2}$ (b) $81^{1/4}$ (c) 27^{0} (d) $4^{-3/2}$ (e) $64^{5/6}$
    (f) $b^5\times b^6$ (g) g^7/g^3 (h) $(x^2)^6$
    (il) $(125/8)^{1/3}$ (j) $(16/9)^{-3/2}$

SECTION 2 – ALGEBRA

1. Simplify the following

   a. $3x + 2y - 2x - 5y + 6$

   b. $6x^2 - 3xy + 11x^2 + 3x + 3xy$

2. Expand and simplify

   a. $3y(4x - 2y)$

   b. $(x + 4)(x - 3)$

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

   d. $(3x - 1)(x + 2) - 3x(2x - 4)$

3. Factorise

   a. $20x^2 - 4x$

   b. $8x^2y + 28xy^2$

   c. $y^3 + 3y^2 - y$

   d. $2x^2 + 5x + 3$

   e. $4x(2x+3) - 3(2x + 3)$

   f. $x^2 - 144$

   g. $15x^2 + 19x + 6$

   h. $9y^2 - 4x^2$

4. Simplify these fractions (write as a single fraction if necessary)

   a. $\frac{3x^2}{7x}$

   b. $\frac{8x^2(x+3)}{4x}$

   c. $3 + \frac{2}{x}$

   d. $\frac{a}{b} - \frac{2a}{3b}$

   e. $\frac{1}{x+1} - \frac{3}{x-2}$

   f. $\frac{x(x-3)}{3} \div \frac{x-3}{x}$

   g. $\frac{x+3}{x^2} \times \frac{x}{4}$

   h. $12x(x+2) \div \frac{3x+6}{x}$

5. a. Make a the subject of the formula $b(a + 2) = 4$

   b. Make C the subject of the formula $F = \frac{9}{5}C + 32$

   c. Make z the subject of the formula $\frac{z+1}{z+4} = \frac{z+2}{z+3}$

   d. Make x the subject of the formula $y = 3\sqrt{\frac{x}{2}}$

SECTION 3 - GRAPHS

1. Find the distance between P(2,6) and Q(5,14).

2. Find the lengths of the sides of the triangle PQR which has vertices at P(-4,2), Q(-1, 6) and R(3,3). What kind of triangle is it?

3. Find the equation of the line with gradient 3 and intercept 5.

4. Find the equation of the line that has gradient -2 and goes through (0,6)

5. Find the gradient of the lines that pass through the following points
   a. (5,6) and (9,15)
   b. (2,12) and (4,1)
   c. (-4,8) and (10,-3)

6. Find the equation of the straight line that passes through the points (2,2) and (6,14)

7. Find the equation of the straight line that passes through the points (-2,3) and (6,-4)

8. Find the equation of the line that is parallel to $y = 2x - 6$ that goes through the point (1,12)

9. Find the equation of the line that is parallel to $2y = 3x - 4$ that goes through the point (2,4)

10. Find the equation of the line that is perpendicular to $y = 2x - 6$ that goes through the point (1, 1)

SECTION 4 – EQUATIONS

1. Solve the following linear equations

   a. $5x + 3 = 3x + 17$ b. $3x - 11 = 3 - x$ c. $3(x + 2) + 2(2x - 5) = 5(x - 1) + 9$

2. Solve the following quadratic equations by **using the quadratic formula**.

   a. $x^2 - x - 5 = 0$ b. $2x^2 - 7x - 1 = 0$

   c. $x^2 = 3x + 5$ d. $-3x^2 + 2x + 1 = 0$

3. Solve the following quadratic equations by **factorising** (remember in C1 you will not have a calculator).

   a. $x^2 + 3x + 2 = 0$ b. $x^2 + 4x - 12 = 0$ c. $x^2 - 4x - 12 = 0$

   d. $x^2 - 14x + 40 = 0$ e. $5x^2 + 13x + 6 = 0$ f. $3x^2 - 16x + 21 = 0$

4. Solve the following quadratic equations by **completing the square**

   a. $x^2 + 6x + 1 = 0$ c. $x^2 - 20x + 34 = 0$

5. Solve the following simultaneous equations

   a. $5x + 3y = 17$
   $4x + 10y = 25$

   b. $7x - 3y = 48$
   $2x + y = 5$

   c. $x = 2y + 1$
   $3x - 4y = 7$

6. Solve the following inequalities

   a. $3x - 8 \leq 30 + x$ b. $10 - 3x < 30 + 2x$

7. Solve the following simultaneous equations

   a. $y = 4x + 7$
   $y = 2x^2 + 1$

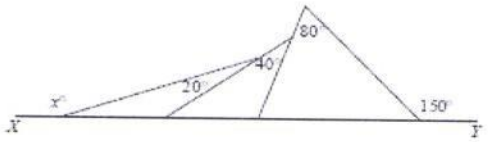
   b. $y = x - 5$
   $x^2 + y^2 = 17$

SECTION 5 – GENERAL QUESTIONS

Question 1.

The diagram shows a rectangle placed on a grid of 1 cm×1 cm squares.
What is the area of the rectangle in cm^2?

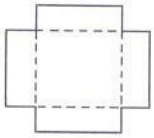
Question 2.



In the diagram, XY is a straight line.
What is the value of x?

Question 3.

A square piece of card has a square of side 2 cm cut out from each of its corners. The remaining card is then folded along the dotted lines shown to form an open box whose total internal surface area is 180 cm^2.



What is the volume of the open box in cm^3?

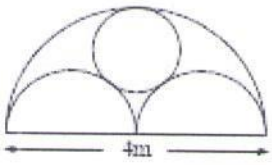
Question 4.

The three blind mice stole a piece of cheese. In the night, the first mouse ate $\frac{1}{3}$ of the cheese. Later, the second mouse ate $\frac{1}{3}$ of the remaining cheese. Finally, the third mouse ate $\frac{1}{3}$ of what was then left of the cheese.

Between them, what fraction of the cheese did they eat?

Question 5.

A window frame in Salt's Mill consists of two equal semicircles and a circle inside a large semicircle with each touching the other three as shown. The width of the frame is 4m.



What is the radius of the circle, in metres?

Question 6.

You are given that $5^p = 9$, $9^q = 12$, $12^r = 16$, $16^s = 20$ and $20^t = 25$. What is the value of $pqrst$?