**Sheet 1**

**From POD 3**

Start with A = 1, B = 3

Keep forming new values of A and B using these rules:

Anew = 2B

Bnew = 2A + 1

which gives:

|  |  |
| --- | --- |
| A | B |
| 1 | 3 |
| 6 | 13 |
| 26 | 53 |

**From POD 2**

"Because 70 is nearer 64 than 81 then √70 is nearer 8 than 9"

Test this statement for numbers and their square roots (include some decimals and some numbers less than 1 etc.)

For which ranges of numbers is the statement not true?

**Now Johnny can do arithmetic (Gattegno)**

2 = 1 x 2

2 + 4 = 2 x 3

2 + 4 + 6 = 3 x 4

2 + 4 + 6 + 8 =

**Sheet 2**

**Van Der Heyden: Algebraic Examples Book 1 (without answers) 1908**

Plot graphs of the following equations:

y = x2 y = 2x2 y = 3x2

x = y2 x = 3y2 y = x2 + 2

y = x2 - 2x = y2 -3 y = (x - 1)2

(followed by more varied examples) - p/c

**From Derek Holton's Problem Solving series:**

Show that x2 - y2 = 74 has no integral solutions

Is it true that x2 - y2 = 2r has no solutions for any natural number r?

For what r does x2 - y2 = 2r have no integral solutions?

Find all the solutions to x2 - y2 = 27

For what integral values of x and y is x2 - y2 divisible by 4?

Decide whether 1122962 - 798962  = 13!

What similar questions can be asked about x3- y3 ; x4 - y4 ; x5 - y5  etc.?

**From MCA**

Observe that x2 + 5x + 6 and x2 + 5x - 6 both factorise

Also both x2 + 13x + 30 and x2 + 13x - 30 factorise.

Find as many examples as you can which factorise whatever sign the constant has.

What is the effect on factorising of changing the sign of the coefficient of x?

Sheet 3

**Spencer's Inventional Geometry 1892:**

Can you place a square in an equilateral triangle?

Can you place a square in an isosceles triangle?

Can you place a square in a quadrant?

Can you place a square in a semi-circle?

Can you place a square in any triangle?

Can you place a square in a pentagon?

**from Mike Ollerton: Getting the \*\*\*\*\*\*\* ....**

Draw different rectangles whose area is 24 cm2

For each rectangle write down the dimensions and calculate perimeter

How many different rectangles with integer dimensions can be drawn?

How can we be sure we have them all?

What are the maximum and minimum perimeters?

What dimensions give the smallest perimeter?

What perimeter values can be obtained if non-integer dimensions can be used?

What does the graph of length against width look like?

What is the equation of this graph?

What does the graph of perimeter against length look like?

What is the equation of this graph?

What does the equation of length against width look like if a different area is chosen?

If we know the area of the rectangle, how can minimum perimeter be found?

If we begin with a constant perimeter, what different rectangles can be formed and what area does each one have?

What does the graph of length against width look like now?

If we know perimeter, what calculation would give us maximum area?

What does the graph of area against length look like?

Sheet 4

**From MME**

all measurements in inches!

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Set A |  |  |  |  |  |  |  |  |
| height | $$\frac{1}{2}$$ | 1 | 1 $\frac{1}{2}$ | 2 | 2 $\frac{1}{2}$ | 3 | 3 $\frac{1}{2}$ | 4 |
| base | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 |
| perimeter |  |  |  |  |  |  |  |  |
| area |  |  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |  |  |
| Set B |  |  |  |  |  |  |  |  |
| height | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 |
| base | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 |
| perimeter |  |  |  |  |  |  |  |  |
| area |  |  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |  |  |
| Set C |  |  |  |  |  |  |  |  |
| height | 2 | 4 | 6 | 8 | 10 | 12 | 14 | 16 |
| base | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 |
| Perimeter |  |  |  |  |  |  |  |  |
| area |  |  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |  |  |

What is the same about all rectangles in set A, set B, set C? Name three other rectangles that could be members of these sets. If possible, find one rectangle that is a member of all three sets. Find a rectangle that is a member of two of the sets. Find one that is in none of the sets.

**From Maxwell's Elementary Coordinate Geometry**

Find the equation of a straight line subject to the two data in each of the following examples:

1. through (1,2) and parallel to OX
2. through (3,-4) and parallel to OY
3. through the origin and (-5,6)
4. through (7,0) and (0,8)
5. through (-7,0) and (0,8)
6. through (-1,0) and (0, -2)
7. through (1,2) and (3,-4)
8. through (-2,8) with gradient 2
9. through (0,1) with gradient -1
10. through (-1,0) with gradient -$\frac{2}{5}$

**Sheet 5**

**Learning and teaching without a textbook (ATM)**

On squared paper: find out how many squares the diagonal of a rectangle passes through.

Write down three digits: find the maximum and minimum values that can be calculated using all three digits, the signs + and/or x, and brackets.

**Organise cylinders into order by size**

**From Geometric Images (ATM) (p/c)**

Sheet 6

**From MME**

In triangle OPX, OP = 1 ft, angle PXO = 90ᵒ, PX = 0.7 ft. What is the angle OPX?

In triangle OPX, OP = 10 ft, angle PXO = 90ᵒ, PX = 7 ft. What is the angle OPX?

In triangle OPX, OP = 7 ft, angle PXO = 90ᵒ, PX = 4.9 ft. What is the angle OPX?

In triangle OPX, OP = 5 ft, angle PXO = 90ᵒ, PX = 3.5 ft. What is the angle OPX?

In triangle OPX, OP = 5 ft, angle PXO = 90ᵒ, PX = 1 ft. What is the angle OPX?

In triangle OPX, OP = 8 ft, angle PXO = 90ᵒ, PX = 2.4 ft. What is the angle OPX?

In triangle OPX, OP = 30 ft, angle PXO = 90ᵒ, PX = 24 ft. What is the angle OPX?

In triangle OPX, OP = 60 ft, angle PXO = 90ᵒ, PX = 42 ft. What is the angle OPX?

In triangle OPX, OP = 45 ft, angle PXO = 90ᵒ, PX = 18 ft. What is the angle OPX?

Sheet 7

**From Krause:**

A = (-2,-1) and B = (2,2)

Sketch the graphs of:

1. the set of all points whose distances from A and B sum to 11
2. the set of all points whose distances from A and B sum to 8
3. the set of all points whose distances from A and B sum to 5 $\frac{1}{2}$
4. the set of all points whose distances from A and B sum to 5
5. the set of all points whose distances from A and B sum to 4

What is the distance from A to B? Does this shed any light on the examples d) e) and c)?

What do you suppose is the general shape of the ellipse whose focal distances add up to 100?

The earth's elliptical orbit is around two foci: one is the sun, the other is 5 million kilometres from the sun. The sum of the focal distances is 300 million kilometres. What is the shape of the earth's orbit?

Sheet 8

**From a Shanghai textbook English version**

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