

**KSHS Mathematics  
Department  
Transition Work**

## Types of Number and Fractions

1) Which of the following are integers?

4   -3.5   0.3    $\frac{4}{5}$    8.99   -10   205   0

2) Which of the following values are rational, and which are irrational?

5.9̇    $\pi$     $\sqrt{7}$     $\frac{1}{5}$    -6    $\sqrt{4}$    13.978   2.1

3) Evaluate the following without using a calculator, giving your answers in their lowest terms. Give any answers larger than 1 as improper fractions.

a)  $\frac{2}{9} \times \frac{3}{5}$    b)  $\frac{1}{6} \div \frac{2}{3}$    c)  $\frac{1}{12} + \frac{5}{6}$    d)  $\frac{8}{5} - \frac{1}{7}$

## Indices, Multiplying out Brackets and Factorising

4) Simplify the following:

a)  $x^7 \times x^2$    b)  $10y^3 \div 5y$    c)  $m^0$    d)  $(2n^2)^5$

5) Write  $5^{-2}$  as a fraction.

6) Evaluate the following without using a calculator:

a)  $\left(\frac{3}{4}\right)^2$    b)  $16^{\frac{1}{2}}$    c)  $8^{\frac{2}{3}}$    d)  $36^{-\frac{1}{2}}$

7) Multiply out the brackets and simplify your answers where possible:

a)  $(x+4)(x-6)$    b)  $(x+5)^2$    c)  $(2x-1)(x+3)$    d)  $(x+1)(x-4)(x+5)$

8) Factorise the following:

a)  $5x+20$    b)  $3a+12ab$    c)  $x^2 - 4$    d)  $9x^2 - 36$    e)  $x^2 - 5$

## Surds

9) Simplify the following:

a)  $\sqrt{3} \times \sqrt{2}$    b)  $(\sqrt{5})^2$    c)  $\frac{\sqrt{30}}{\sqrt{6}}$    d)  $\sqrt{12} + 2\sqrt{3}$    e)  $(1 + \sqrt{7})^2$

10) Rationalise the denominators of the following:

a)  $\frac{3}{\sqrt{2}}$    b)  $\frac{\sqrt{5}}{2\sqrt{2}}$    c)  $\frac{2}{3+\sqrt{6}}$    d)  $\frac{\sqrt{2}}{1-\sqrt{5}}$

## Solving Equations and Rearranging Formulas

11) Solve the following:

a)  $5x - 2 = 8$       b)  $3(x - 6) = 2(x - 4)$       c)  $\frac{x+2}{3} + \frac{2x}{5} = x + 2$       d)  $2x(x+1) = 2x+18$

12) Make  $x$  the subject of the following formulas:

a)  $y = mx + c$       b)  $y = \frac{3x+2}{5}$       c)  $y = 2x^2z + 1$       d)  $y = \frac{3x+1}{x-2}$

## Quadratic Equations

13) Solve the following by factorising:

a)  $x^2 - 3x + 2 = 0$       b)  $x^2 + 6x + 5 = 0$       c)  $2x^2 - 3x - 5 = 0$       d)  $3x^2 - 13x = -12$

14) Solve the following using the quadratic formula. Give your answer to two decimal places.

a)  $x^2 + 2x - 10 = 0$       b)  $2x^2 - 5x - 1 = 0$

15) Solve the following by completing the square. Give your answers as surds.

a)  $x^2 - 4x - 2 = 0$       b)  $2x^2 + 4x - 7 = 0$

16) a) Complete the square for  $x^2 + 6x + 8$

b) Hence sketch the graph of  $x^2 + 6x + 8$ , labelling the turning point and the intercepts with the  $x$  axis.

## Algebraic Fractions, Inequalities and Simultaneous Equations

17) Simplify the following:

a)  $\frac{15a^3b^3}{5a^2b}$       b)  $\frac{2x^2y}{(4xy)^2}$       c)  $\frac{x^2-16}{x^2-x-20}$

18) Simplify the following:

a)  $\frac{9b^2}{a} \times \frac{2a^2}{3b}$       b)  $\frac{2(x-1)^2}{15} \times \frac{10}{4x-4}$       c)  $\frac{3x^2-21x}{x+2} \div \frac{x(x-7)}{9x+18}$       d)  $\frac{3}{x+1} + \frac{2x-3}{x^2}$

19) Solve the following inequalities:

a)  $7x + 5 \leq 2x$       b)  $2(10 - x) > 4$       c)  $2x^2 + 3 < 21$       d)  $4x^2 - 9 \geq 7$       e)  $x^2 - 4x + 10 \geq 2x + 5$

20) Draw a set of axes with the  $x$ -axis from  $-2$  to  $3$  and the  $y$ -axis from  $0$  to  $6$ . Show on these axes the region that satisfies the following inequalities:

$$y > 3x - 1, \quad y < x + 3 \quad \text{and} \quad y \geq \frac{x}{5} + 2$$

21) Solve the following simultaneous equations:

a)  $2x + y = 2$        $x - 3y = 8$       b)  $y = x^2 + 3$        $y - 2x = 18$

## Proof and Functions

22) Prove that the sum of any three consecutive odd numbers is a multiple of 3

23) Mia says, "for any integers  $x$  and  $y$ ,  $xy > y$ ". Prove that Mia is wrong.

24)  $f(x) = \frac{x+5}{3}$  and  $g(x) = x - 3$

a) Evaluate  $f(4)$       b) Find  $fg(x)$       c) Find  $f^{-1}(x)$

## Straight Lines and Quadratic Graphs

25) Give the gradient and  $y$ -intercept of the line  $x+2y=4$

26) Point A has coordinates (5,2) and point B has coordinates (2,-4).

a) Find the equation of the line passing through the points A and B

b) Find the exact length of line AB

27) Line A has equation  $y=2x+5$

a) Find the equation of the line parallel to line A which passes through (3,2)

b) Find the equation of the line perpendicular to line A which passes through (2,1)

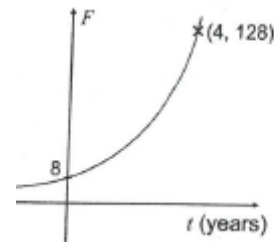
28) Sketch the graph of  $y = x^2 - 8x + 15$ . Label the graph with the coordinates of the turning point and the points where the graph crosses the axes.

## Harder Graphs and Graph Transformations

29) Sketch the following graphs:

a)  $y = x^3$       b)  $y = \frac{1}{x}$       c)  $y = -\frac{1}{x}$

30) The graph on the right shows how the number of fish ( $F$ ) living in a river changes over time. The equation of the graph is  $F = mn^t$  where  $t$  is the number of years and  $m$  and  $n$  are positive constants. Find the values of  $m$  and  $n$ .



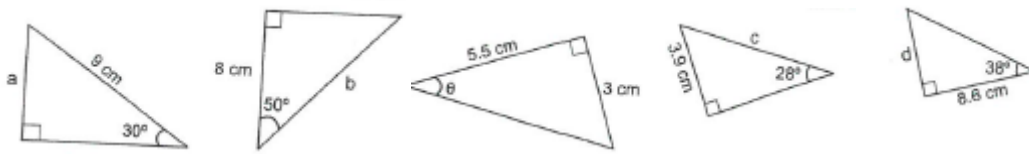
31) Find the equation of the tangent to  $x^2 + y^2 = 25$  at the point (3,4). Give your answer in the form  $ax+by+c=0$

32)  $f(x) = x^2$ . For parts a) to C) below sketch the graphs of  $y=f(x)$  and the given transformation.

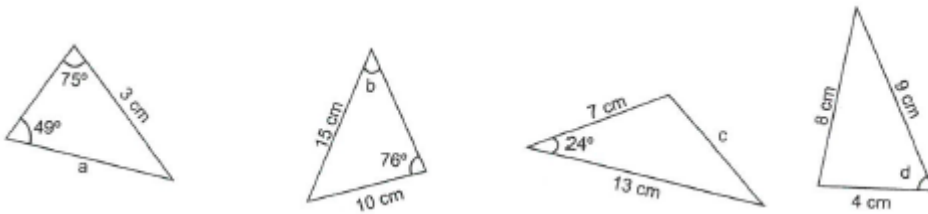
a)  $y = f(x) + 3$       b)  $y = f(x + 3)$       c)  $y = -f(x)$

# Trigonometry and Vectors

33) Find the unknowns in each of these triangles. Give your answers to 1 decimal place.



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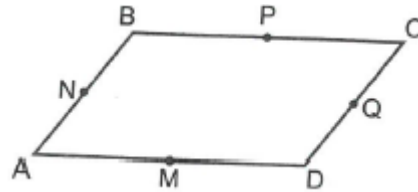
35) ABCD is the parallelogram shown on the right.

M, N, P and Q are the midpoints of the sides.

If  $\vec{AB} = \mathbf{a}$  and  $\vec{BC} = \mathbf{b}$ .

Find the following vectors in terms of  $\mathbf{a}$  and  $\mathbf{b}$ .

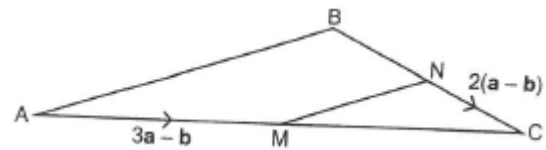
- a)  $\vec{AC}$    b)  $\vec{DQ}$    c)  $\vec{CM}$    d)  $\vec{QP}$    e)  $\vec{MB}$    f)  $\vec{PA}$



36) The diagram shows triangle ABC.

M is the midpoint of  $\vec{AC}$  and N is the midpoint of  $\vec{BC}$

If  $\vec{AM} = 3\mathbf{a} - \mathbf{b}$  and  $\vec{NC} = 2(\mathbf{a} - \mathbf{b})$ . Show that  $\vec{AB}$  and  $\vec{MN}$  are parallel.



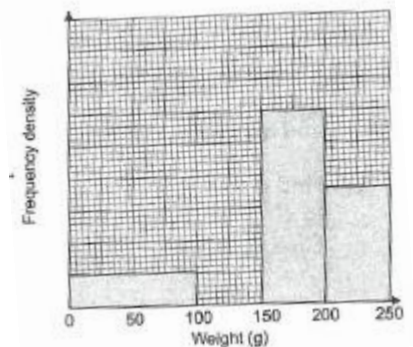
# Sampling and Histograms

37) Describe how a simple random sample of size 20 can be selected from a population of 200.

38) The weights of the chocolate bars in a shop storeroom are shown in the table and histogram.

- Use the information in the table and the histogram to label the vertical axis.
- Use the histogram to complete the table.
- Use the table to add the missing bar to the histogram.

Weight ( $w$ , in grams)	Frequency
$0 < w \leq 100$	50
$100 < w \leq 150$	100
$150 < w \leq 200$	150
$200 < w \leq 250$	



# Averages and Cumulative frequency

39) Find the mean, median and mode(s) of these numbers

- 5   3   -2   0   -3   2   1   1   4   2   6   11   -4

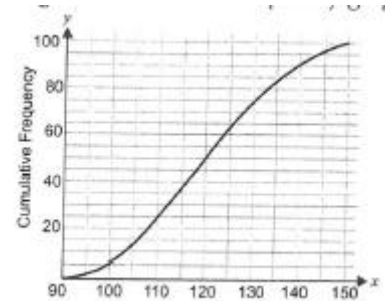
40) The table shows the journey times between home and school for 60 students.

- Write down the modal class.
- Which group contains the median?
- Estimate the mean value,
- Draw a cumulative frequency graph for the data in the table.

Time ( $m$ minutes)	Frequency
$5 < m \leq 10$	4
$10 < m \leq 15$	25
$15 < m \leq 20$	18
$20 < m \leq 25$	8
$25 < m \leq 30$	5

41) Using this cumulative frequency graph, find the:

- median
- lower quartile
- upper quartile
- interquartile range



## Probability and Tree Diagrams

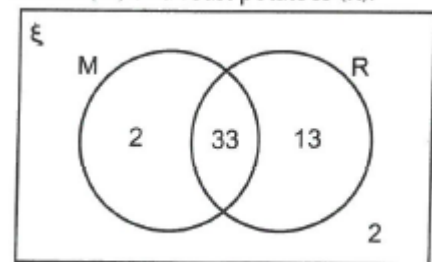
42) Lewis asked 50 people if they like mashed potatoes (M) and roast potatoes (R).

The Venn diagram shows the results.

A person is chosen at random.

Find the probability that they:

- Like mashed potatoes
- Like neither mashed nor roast potatoes
- Like both types of potatoes
- Don't like roast potatoes
- Don't like mashed potatoes



43) Mona's purse contains two £5 notes, four £10 notes and three £20 notes. It also contains five 20p coins, four 50p coins and three £1 coins.

- Mona picks one note and one coin at random from the purse. Find the probability that she picks a £5 note and a 20p coin.
- Mona picks two coins at random without replacement. Use a tree diagram to find the probability she picks a 50p coin and a £1 coin.