# Paper 3 Revision (Higher)

# Key topics to practice for 11<sup>th</sup> June

All the topics listed below are likely to appear in some form in paper 2 or 3.

Scan the QR code for solutions and then select

Г

### Very Likely topics

Compound interest/Growth and decay	Volume of 3D shapes	Recurring decimals to fractions	Changing the subject
Product rule for counting	Pythagoras	Form algebraic equation in context	Iteration
Sine Rule	Speed/time graphs	Similar Area/Volume	Sequences
Use of probability to estimate/ work out an amount	Cumulative Frequency/Box plots	Increase/Decrease by %	

### Likely topics

Gradients, Intercepts, y=mx+c	Simplifying algebraic expressions	Congruence	Expanding/factorising
Solve linear equations	Averages and range	Venn diagrams	



### Very Likely – Increase/Decrease by a %

#### Q1.

A bus route had 90 000 passengers last year.

The number of passengers was predicted to increase

by 3% this year and then by 8% next year.

Is the predicted number of passengers for **next** year more than 100 000 ? You **must** show your working.

#### Q2.

Magana decides to put £500 into an account that pays compound interest. She wants to have **at least** £560 in the account after 3 years.

Work out to 1 decimal place the minimum annual interest rate she needs.

(Total 3 marks)

#### Q3.

£2448 is invested in an account at a rate of compound interest. One year after the investment there is £2496.96 in the account.

How much is in the account four years after the investment?

(Total 3 marks)

## Very Likely – Volume of 3D shapes

### Q1.

A cylinder, C, and a sphere, S, each have radius r

C has height h



(a) volume of C = volume of S

Work out the ratio r:hYou **must** show your working.

#### (b) A different cylinder has radius 3r and height 2h.

How many times bigger is the volume of this cylinder than the volume of C?

(2) (Total 5 marks)

Outside a cafe there is a large plastic ice cream cornet.

The cornet is a hemisphere on top of a cone.



The cone and the hemisphere each have radius 24 cm The cone has perpendicular height 117 cm

Volume of a cone =  $\frac{1}{3} \pi r^2 h$ r is the radius

h is the perpendicular height

(a) Work out the total volume of the cornet.

Volume of a hemisphere =  $\frac{2}{3}\pi r^3$ r is the radius

(b) The actual cornets that the cafe sells are similar to the plastic one.
For the actual cornets, the cone and the hemisphere each have radius 2cm
How many times greater is the volume of the plastic cornet than an actual cornet?

### Q3.

Alec makes a bowl for dog food from a solid wooden cone. The sketches show how the bowl is made.

The cone has radius 9 cm and perpendicular height 30 cm A smaller cone, with radius 6 cm, is removed.



A hemisphere with radius 6 cm is then removed.



Work out the volume of the remaining wood that forms the bowl.

### Very Likely – Recurring decimals to fractions

### Q1.

Which of these when converted to decimals are recurring decimals? Circle your answers.

	$\frac{1}{3}$	π	$\sqrt{3}$	<u>3</u> 16	5 7	
						(Total 2 marks)
<b>Q2.</b> Work out	0.7048-0.001					
Circle your a	answer.					
	0.7038	0.7038		0.70383	0.70384	
						(Total 1 mark)
Q3.						

			124
Prove algebraically that	2.75	converts to the fraction	45

### Very Likely - Changing the subject

### Q1.

 $a \times b^4 = c$ 

Circle the correct expression for *a*.



(Total 1 mark)

#### Q2.

Rearrange  $a = \frac{b}{c} + 5$  to make *c* the subject.

(Total 3 marks)

#### Q3.

Rearrange  $9m + 4(2m - 1) = p^2 + pm$  to make *m* the subject.

(Total 4 marks)

#### Q4.

Rearrange  $p = \frac{2m+1}{1-m}$  to make *m* the subject.

(Total 4 marks)

### Very Likely – Product rule for counting

#### Q1.

A vending machine has a different item in each section. It sells

7 drinks, 3 of which are juice

5 snacks, 2 of which are fruit bars

11 meals, 4 of which are salad.

One drink, one snack and one meal are chosen at random.

Show that the probability of getting a juice, a fruit bar and a salad is more than 5%

(Total 3 marks)

Fatima is choosing a 4-digit code. Each digit is a whole number from 0 to 9

She decides

all her digits will be odd numbers

no digits will be repeated.

How many different codes can she make?

(Total 2 marks)

#### Q3.

A code has 4 digits.

Each digit is a number from 0 to 9 Digits may be repeated.

The code starts 5 4 1

5 4 1
-------

(a) Amy knows the last digit is odd but **not** 7She chooses a different odd number at random.

What is the probability that she chooses the correct number?

(b) The 4-digit code is changed to an even number. The first digit is 3

How many possible codes are there?

(2) (Total 3 marks)

### Very Likely – Pythagoras

### Q1.

Use Pythagoras' theorem to work out the value of *x*.



(Total 3 marks)

A shape is made by joining a right-angled triangle to a rectangle.



Work out the area of the shape.

(Total 5 marks)

Q3.

All dimensions are in centimetres.



### Q1.

AB, CD and EF are straight lines.



(a) Ava assumes that *AB* and *CD* are parallel.What answer should she get for the size of angle *y*?

(b) In fact,

AB and CD are **not** parallel

angle w is 60°

What effect does this have on the size of angle *y*? Tick a box.



Show working to support your answer.

The table shows information about some CDs.

Туре	Rock	Рор	Jazz
Number of CDs	2	x	2 <i>x</i> + 5

1

A CD is chosen at random.

The probability it is **rock** is  $\overline{20}$ 

Work out the probability it is jazz.

(Total 4 marks)

### Very Likely – Iteration

### Q1.

An approximate value of a root of an equation, *x*, can be found using the iterative formula

$$x_{n+1} = \sqrt[3]{5(x_n)^2 - 2x_n - 3}$$

The starting value is  $x_1 = 4$ 

(a) Work out the values of  $x_2$  and  $x_3$ 

(b) By continuing the iteration, show that the value of *x* is more than 4.25

(1) (Total 3 marks)

(2)

$$x_{n+1} = 5 - \frac{1}{x_n}$$

Use  $x_1 = 1$  to work out an approximate solution to Give your answer to 4 significant figures.

$$x = 5 - \frac{1}{x}$$

(Total 3 marks)

#### Q3.

This iterative process can be used to find approximate solutions to  $x^2 - 7x - 3 = 0$ 



(a) Use this iterative process to find a solution to 4 decimal places of  $x^2 - 7x - 3 = 0$ 

Start with the value x = 7

(b) By substituting your answer to part (a) into  $x^2 - 7x - 3$ comment on the accuracy of your solution to  $x^2 - 7x - 3 = 0$ 

### <u> Very Likely – Sine rule</u>

### Q1.

Q2.

Work out the area of triangle ABC.



Not drawn accurately

(Total 4 marks)



Not drawn accurately

Work out the value of *x* 

### Q3.

ABC and ACD are triangles.



Work out the size of angle x.

### Q1.

Here is a sketch of a speed-time graph for part of a journey.



The average speed from 0 to t seconds was 7.2 m/s Work out the value of t

(Total 5 marks)

Here is the velocity-time graph of a cyclist for 40 seconds.



(a) By dividing the area under the graph into four sections of equal widths, estimate the distance travelled during the 40 seconds.

(b) Work out the average acceleration of the cyclist during the 40 seconds. State the units of your answer. (3)

Q3.

The speed-time graph for a car's journey is shown.



- (a) Estimate the acceleration at 6 seconds. You **must** show your working.
- (b) Estimate the average speed of the car for the journey. You **must** show your working.
- (c) Evaluate your answer to part (b).

Tick a box.



(1) (Total 8 marks)

(3)

(4)

### Q1.

Here are two similar cones.



The surface area of cone A is 2 m<sup>2</sup>

The surface area of cone B is 4.5  $m^{\scriptscriptstyle 2}$ 

Work out the ratio radius of cone A : radius of cone B

Give your answer in the form 1:n

Here are two square-based paving stones.

The stones are similar solids.





25 cm

The price per cm<sup>3</sup> is the same for both stones. The price of the **larger** stone is £17.50

Work out the price of the smaller stone.

### Very Likely – Sequences

### Q1.

Work out the next term of this quadratic sequence.

	5	8	1	4	23		
							(Total 2 marks)
Q2.							
A is a	n <b>arithmetic</b> pro	ogression.					
Here	are the first four	terms.					
	13		16	19	)	22	
G is a	<b>geometric</b> prog	gression.					
Here	are the first four	terms.					
	2	2	4	8		16	
	<i>n</i> th term of A =	= 8th term of (	3				

Work out the value of *n*.

### Q3.

Here are the first four terms of a quadratic sequence.

3 20 47 84

Work out an expression for the *n*th term of the sequence.

(Total 4 marks)

### Q4.

(a) The *n*th term of a sequence is  $n^2 + 12n + 27$ 

By factorising, or otherwise, show that the 20th term can be written as the product of two prime numbers.

(b) The *n*th term of a different sequence is  $n^2 - 6n + 14$ 

By completing the square, or otherwise, show that every term is positive.

(3) (Total 5 marks)

### Q1.

Rosie makes phone calls to try to sell broadband.

Today, she made 120 calls.

The table shows the results.

Result of call	Frequency
Not answered	33
Answered but sale not made	81
Answered and sale made	6

(a) Write down the relative frequency that a call was **not answered**.

(b) During the **rest of the week**, Rosie will make 500 calls.

Using the results in the table, how many sales does she expect to make during the **rest of the week**?

A bag contains white beads, black beads and red beads.

The following trial is repeated 100 times.

Pick a bead at random. Record the colour. Put the bead back in the bag.

The graph shows the relative frequency of a white bead after every 20 trials.



- (a) Work out the number of times a white bead was picked in the first 20 trials.
- (b) What is the best estimate for the probability of picking a white bead? Give a reason for your answer.

(2)

(c) There are a total of 1000 beads in the bag.

Estimate the number of beads that are white.

(2) (Total 6 marks)

### Q3.

A spinner was spun 200 times.

The relative frequency of landing on 4 after 50, 100, 150 and 200 spins is shown.

Number of spins	50	100	150	200
Relative frequency	0.14	0.13	0.18	0.16

(a) Which relative frequency gives the best estimate of the probability of the spinner landing on 4?

Give a reason for your answer.

(b) How many times did the spinner land on 4 from spin 51 to spin 100?

(2)

### Very Likely – Cumulative frequency/Box plots

### Q1.

The table shows information about the ages of 100 rugby supporters.

Age, <i>a</i> (years)	Frequency
5 ≤ <i>a</i> < 15	12
15 ≤ <i>a</i> < 20	11
20 ≤ <i>a</i> < 40	25
40 ≤ <i>a</i> < 55	39
55 ≤ <i>a</i> < 70	13

(a) Plot a cumulative frequency diagram for the data.



(4)

(b) The youngest supporter is 8 years old. The oldest supporter is 69 years old.

Draw a box plot for the data.



(3) (Total 7 marks)

### Q2.

The cumulative frequency graph shows information about the masses of 200 apples.



<sup>(</sup>a) Estimate the median mass.

(b) Apples with mass 90 grams or less cost 32p each.Apples with mass more than 90 grams cost 39p each.

Estimate the total cost of the 200 apples.

(3) (Total 4 marks)

### Q3.

Two groups of people are trying to lose weight.

(a) Group A join a gym. The graph shows information about their weight loss after one month.



- (i) How many people are in group A?
- (ii) Does everyone in group A lose weight? Write down how you decide.

(1)

(1)

### (b) Group B follow a diet.

The box plot shows information about their weight loss after one month.



Does everyone in group B lose weight? Write down how you decide.

(c) Compare the weight loss of group A with group B.

(5) (Total 8 marks)

(1)

Q1.

Draw the graph of  $y = 1 - \frac{1}{2}x$  for values of x from -2 to 4



(Total 3 marks)

A straight line passes through (3, 14) and (12, 32)

Work out the equation of the line.

Give your answer in the form y = mx + c

(Total 3 marks)

#### Q3.

Write down the equation of the straight line that

passes through the point (0, 4)

#### and

is parallel to the line y = 5x + 3

(Total 2 marks)

### Likely – Simplifying algebraic expressions

### Q1.

Expand  $(x^2 - 9xy)(2x + 5y)$ 

(Total 2 marks)

### Q2.

Simplify

$$\frac{25a}{8} \times \frac{2a}{5}$$

Give your answer as a single fraction in its simplest form.

(Total 2 marks)

### Q3.

Expand and simplify fully 4(2c + 3) - (5c - 1)

(Total 2 marks)

Q4.

Simplify fully 
$$\frac{8x^2 + 4}{5x} \times \frac{3x}{14x^2 + 7}$$

You must show your working.

(Total 3 marks)

### Likely – Congruence

### Q1.

Which of these is not used to prove that triangles are congruent?

Circle your answer.

SSS

SAS

AAA

(Total 1 mark)

RHS

ABCD is a trapezium.

All four sides are different lengths.

AB is parallel to CD.

The diagonals intersect at X.



For each statement, tick the correct box.

	True	May be true	Not true	
Triangles AXB and CXD are similar				
Triangles AXD and BXC are congruent				
Angle <i>ADB</i> = angle <i>BDC</i>				
Area of triangle <i>ABC</i> = area of triangle <i>ABD</i>				
			(Т	0

#### (Total 4 marks)

The straight lines AE and BD intersect at C.

Not drawn accurately



Prove that triangles ABC and EDC are congruent.

(Total 5 marks)

#### Q4.

AC is a diameter of a circle, centre *E*. *E* is the midpoint of *BD*.



Prove that triangle ABE is congruent to triangle CDE.

(Total 4 marks)

### Likely – Expanding/factorising

### Q1.

Expand  $(x^2 - 9xy)(2x + 5y)$ 

(Total 2 marks)

### Q2.

Factorise fully  $x^3 - 49x$ 

Factorise  $x^2 + 2x - 24$ 

(Total 2 marks)

Q3.

(Total 2 marks)

#### Q4.

Factorise  $25a^2 - b^2$ 

(Total 1 mark)

### Q5.

Expand and simplify fully (x-3)(x-4)(x+8)

(Total 3 marks)

### Q6.

Factorise fully  $144 - 4x^2$ 

(Total 2 marks)

Q7.

(a) Factorise  $5x^2 + 6x - 8$ 

(b) Simplify fully 
$$\frac{x^2 + 9x + 14}{x^2 - 4}$$

(3) (Total 5 marks)

### Likely – Solve linear equations

### Q1.

Solve 5x + 11 = 3x + 19

(Total 2 marks)

The diagram shows a square.



Work out the length of one side of the square.

(Total 4 marks)

### Q3.

Solve

 $\frac{x+15}{3} = 2(x+10)$ 

(Total 4 marks)

### Q4.

Work out the value of x when

x - 20: x + 280 simplifies to 1:4

(Total 4 marks)

#### Likely – Averages and range

#### Q1.

Five integers have: a mode of 1 a median of 2

a mean of 3

What is the greatest possible range of the five integers? You **must** show your working.

(Total 3 marks)

Students in a class took a spelling test.

The diagram shows information about the scores.



Lucy is one of the 29 students in the class.

Her score was the same as the **median** score for her class.

Work out her score.

(Total 2 marks)

#### Q3.

The number of goals scored by 20 players in a season is shown.

Number of goals	Frequency	Midpoint	
0 to 4	6		
5 to 9	11		
10 to 14	3		
	Total = 20		

Work out an estimate of the mean number of goals per player.

Give your answer as a decimal.

### <u>Likely – Venn diagrams</u>

### Q1.

A school has 86 teachers.

- 42 are male and 44 are female.
- 1
- $\overline{\mathbf{3}}$  of the male teachers have blue eyes.
- 1
- $\overline{4}$  of the female teachers have blue eyes.
- (a)  $\xi$  = teachers in the school
  - M = male teachers
  - B = teachers who have blue eyes



Complete the Venn diagram.

(b) One teacher who has blue eyes is chosen at random.

Work out the probability that the teacher is male.

(3)

The Venn diagram shows some information about 150 students.

- $\xi$  = 150 students
- C = students who study Chemistry
- P = students who study Physics



5

The probability that a Physics student, chosen at random, also studies Chemistry is  $\overline{12}$ One of the 150 students is chosen at random.

Work out the probability that the student does **not** study either Chemistry or Physics.

### Q3.

The Venn diagram shows information about a coin collection.

- $\xi$  = 150 coins in the collection
- T = coins from the 20th century
- B = British coins



A coin is chosen at random. It is British.

Work out the probability that it is from the 20th century.