National College of Ireland

PAPER 1

Sample Questions

ABSTRACT
Revision Notes

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Ordinary Maths

Algebra Topics

Q1. SOLVING LINEAR EQUATIONS - 2014 Q 3

(i) Solve for x: $2(4 - 3x) + 12 = 7x - 5(2x - 7)$

(ii) Verify your answer to (i) above.

Q2. SOLVING QUADRATIC EQUATIONS – 2015 Q4

Solve the equation $-x^2 + 6x - 4 = 0$. Give each solution correct to one decimal place.

Q3. INEQUALITIES – 2015 Q3

List all the values of x that satisfy the inequality $2 - 3x \geq -6, x \in N$

Q4. SIMULTANEOUS EQUATIONS – 2012 Q3

Solve for x and y

$$x - y + 5 = 0$$

$$x^2 + y^2 = 17$$

Algebra Topics

Q5. SIMPLIFYING – 2015 Q3

Simplify 3(4 − 5x) − 2(5 − 6x).

Q6 DIVISION – 2012 Q2

Let f (x) = x³ + 2x² - x + 2

(i) Show, by division, that x – 1 is a factor of f (x)

(ii) Hence, or otherwise, find the other factors of f(x)

Q7 FRACTIONS – 2012 Q2

Let, $g(x) = \frac{1}{x^2} - \frac{1}{2x}$ and $h(x) = 1 - \frac{2}{x}$, where $x \neq 0$ and $x \in R$

(i) Show that h(x) = - 2x[g(x)]

(ii) Find the values of x for which g(x) = h(x)

Arithmetic / Rounding / Indices Topics

Q1. EXCHANGE RATES – 2015 Paper Q1

Padraic works in America and travels between Ireland and America.

(a) In Ireland, he exchanged €2000 for US dollars when the exchange rate was €1 = $1·29. Find how many US dollars he received.

(b) Padraic returned to Ireland and exchanged $21 000 for euro. He received €15 000. Write the exchange rate for this transaction in the form €1 = $0·00.

Padraic wants to exchange some dollars for sterling. On a day when the euro to dollar exchange rate is €1 = $1·24 and the euro to sterling exchange rate is €1 = £0·83, find the dollar to sterling exchange rate. Write your answer in the form $1 = £ 0·00.

Q2 COMPOUND INTEREST - 2014 Paper Q7

(a) Mary bought a new car for €20 000 on the 1st July 2010. The value of the car depreciated at a compound rate of 15% each year. Find the value of the car, correct to the nearest euro, on the 1st July 2014.

(b) Mary wishes to buy a new car, which costs €24 000, on the 1st July 2014. (i) Buy Right Car Sales offers Mary €10 500 for her old car. She can borrow the balance for one year at a rate of 11·5%. How much would she repay on 1st July 2015?

(ii) Bargain Deals Car Sales offers Mary €10 000 for her old car and an interest free loan of the balance for six months. At the end of the six months Mary would make a payment of €4000 and would be charged interest at a compound rate of 1·5% per month for the next six months. How much would Mary repay on 1st July 2015?

(iii) Which of the above options should Mary choose if she wishes to pay the least amount? Justify your answer by calculation.

Q3 – ROUNDING / % CHANGES – DEB Pre-Leaving Cert 2016 Q2

The Summer Olympic Games will take place in Rio de Janeiro, Brazil, in 2016.

(a)   According to the 2010 Census, the population of the host city was 5940 224. Write this number in the form $a \times 10^n$, where $1 \le a \le 10$ and $n \in N$, correct to two significant figures.

(b)   According to the most recent estimate, the population of the city is now 6453 682. (i) Use your answer to part (a) above to calculate the population growth rate (% change in population) of city, correct to two decimal places.

(c)   Find the percentage error in using your answer to part (a) above instead of the actual figure to calculate the population growth rate, correct to two decimal places.

Arithmetic / Rounding / Indices Topics

Solve the equation $27^{2x} = 3^{x+10}$

Write 6^{-2} and $81^{\frac{1}{2}}$ without using indices (2014 – sample Q1)

Show that $\dfrac{(a\sqrt{a})^3}{a^4}$ simplifies to $\sqrt{a}$ (2014 – sample Q1)

PRACTICE MORE ON SIMILAR EXAMPLES:

2014 Q1: A shopkeeper bought 25 school blazers at €30 each and 25 trousers at €20 each. (a) Find the total cost to the shopkeeper. (b) The shopkeeper sells a blazer and a trousers as a set for €89·95. Find her profit on this transaction. (c) The shopkeeper sells 22 blazer and trouser sets at €89·95 each. She sells the remaining 3 sets at a discount of 20% on the selling price. Find her mark up (profit as a percentage of cost price) on the total transaction.

2012 Q1: When Katie had travelled 140 km, she had completed 9 4 of her journey. Find the length of her journey.Robert's electricity bill gave the following data:

Unit type	Present reading	Previous reading	Unit price
Day rate	35 087	34 537	€0·1506
Night rate	17 213	16 853	€0·0745

(i) Calculate the total cost of the units used. Robert also pays a standing charge of €24·89 and a levy of €5·46. VAT at the rate of 13·5% is charged on all amounts.
(ii) Calculate the total amount of Robert's electricity bill.

He sold 10 of the toys at €33·88 each and sold the remaining 30 toys at a reduced price. His total sales amounted to €1270. (i) Write his total profit on the transaction as a percentage of his cost. Give your answer correct to one decimal place. (ii) Find the reduced selling price of each of the remaining 30 toys.

Calculus

Q1. FINDING F'(X) AND THE TURNING POINTS

Find the co-ordinates of the turning point of the function $f(x) = -x^2 + 6x - 4, x \in R$ *(2015 Q4)*

The function f is defined as $f(x) = x^3 + 3x^2 - 9x + 5, where\ x \in R$

Find the co-ordinates of the local maximum turning point and of the local minimum turning point of the function.   *(2014 Q5)*

Q2. FINDING MAX/MIN - SPEED/ ACCELERATION

A stone is thrown vertically upwards. The height s metres, of the stone after t seconds is given by:

S = 5(4t - t²)   *(2013 Q8)*

  (i)   Find the height of the stone after 1 second
  (ii) Show that the stone momentarily stops two seconds after being thrown, and find its height
          at that time.
  (iii) Show that the acceleration of the stone is constant

Calculus

A ball is thrown vertically down from the top of a high building. The distance, s metres, the ball falls is given by $2s = 3t + 5t$ where t is the time in seconds from the instant the ball is thrown. *(2012 Q7)*

    (i)   Find the speed of the ball after 3 seconds.

    (ii) Find the time t when the ball is falling at a speed of 23 ms^{-1}.

    (iii) The ball hits the ground at a speed of 38 ms^{-1}. How high is the building?

The volume of a box, in terms of h is: $4h^3 - 48h^2 + 144h$. (h=height & length of sides)
      (2014 Q8)

    (i)   Find the value of h which gives the box its maximum volume.

    (ii) Find the maximum volume of the box

Complex Numbers

Q1. BASIC ARITHMETIC WITH COMPLEX NUMBERS

Let $z_1 = 5 - i$ and $z_2 = 4 + 3i$, where $i^2 = -1$ *(2014 Q2)*

    (a) Find $z_1 - z_2$

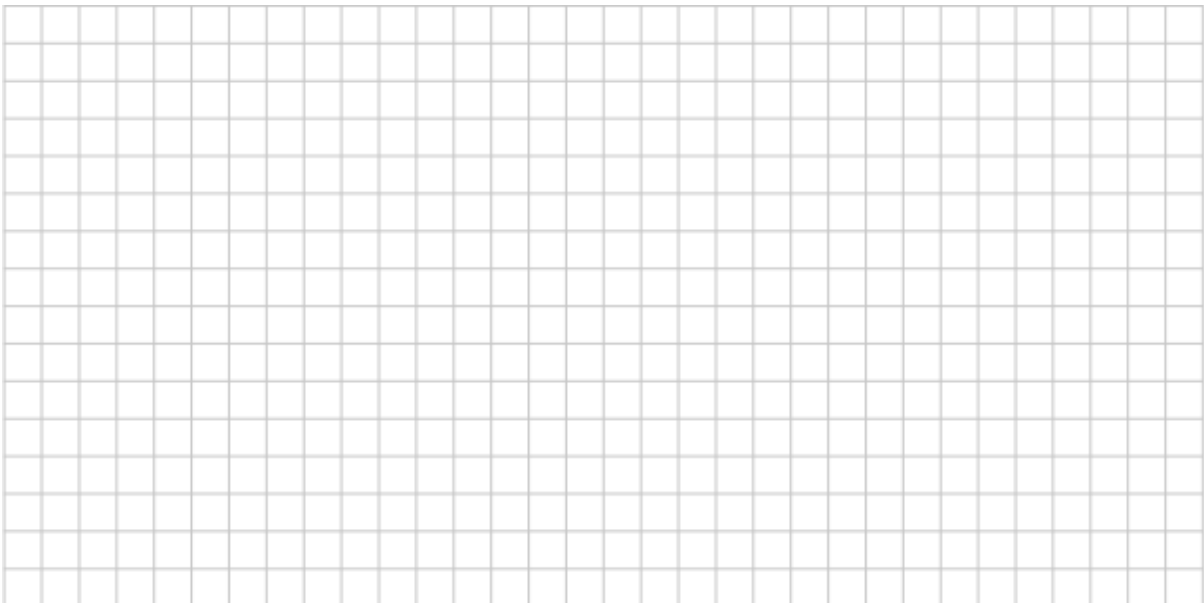Given that $6 - 4i + 3u = 5i$, where $i^2 = -1$ *(2012 Q4)*

    (i) Find u

$Z = 2 + 5i$ is a complex number, where $i^2 = -1$ *(DEB Mock 2016)*

    (a) Find iz

Q2. PLOTTING COMPLEX NUMBERS

Plot all of the points in Q1 – (a) z_1,   (b) z_2,   (c) u and   (d) iz

Complex Numbers

Q3 THE MODULUS

Verify algebraically that $| z_1 | > | z_2 |$, $z_1 = 3 - 4i$ $z_2 = 1 + 2i$ *(2013 Q1)*
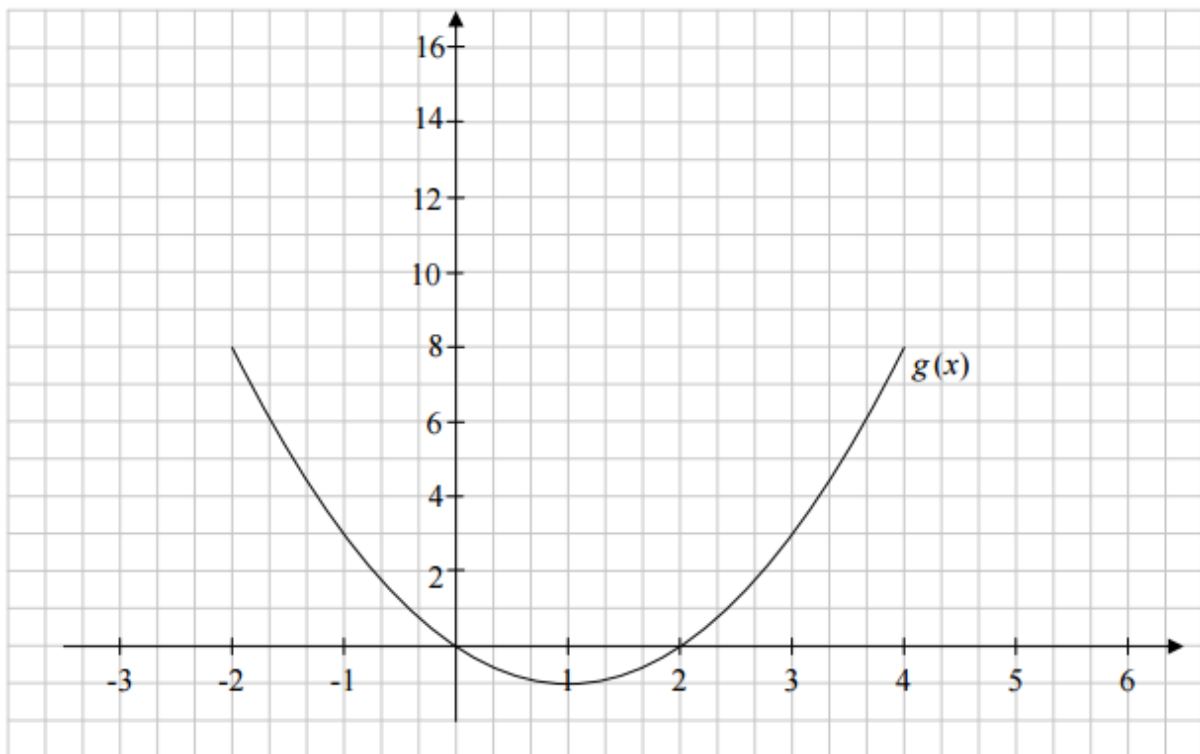
Q4 WORKING WITH THE CONJUGATE

Find $\dfrac{z_1}{z_2}$ in the form x + yi, where x, y $\in \mathbb{R}$ *(2013 Q1)*

Let $z = 1 + i$ (ii) Show that $z^2 + \bar{z}^2$, where $\bar{z}$ is the complex conjugate of z   *(2012 Q4)*

GRAPHING A FUNCTION & VARIATIONS OF THE FUNCTION – 2014 Q4

The graph of the function $g(x) = x^2 - 2x$, where $x \in R$, is shown below. On the same diagram, sketch the graph of each of the functions: (i) $h(x) = g(x) + 2$ (ii) $k(x) = g(x + 2)$

Sequences and Series

Q1. FINDING TERMS WHEN GIVEN THE GENERAL TERM

(a) The nth term of a sequence is $T_n = \dfrac{2n-1}{n+1}$. Find the sum of the second and third terms of the sequence. *(2012 Q5)*

(b) The general term of an arithmetic sequence is $T_n = 15 - 2n, \text{ where } n \in \mathbb{N}.$

           (i) Write down the first three terms of the sequence.

           (ii) Find the first negative term of the sequence *(2014 Q6)*

Q2. FINDING THE GENERAL TERM & THE SUM OF ALL TERMS (QS RELATING) - 2013 Q6

The first term of an arithmetic series is 2 and the eighth term is 30.

(i) Find T3 , the third term of the series.

Two brothers, Eoin and Peter, began work in 2005 on starting salaries of €20 000 and €17 000 per annum, respectively. Eoin's salary increased by €500 per annum and Peter's salary increased by €1250 per annum. This salary pattern will continue.

(i) Find, in terms of n, a formula that gives Eoin's salary in the n th year of the pattern.

Sequences and Series

(ii) Using your formula, or otherwise, find Eoin's salary in 2015.

(b) Find, in terms of n, a formula that gives the total amount earned by Peter from the first to the n th year of the pattern.

(c)Using your formula, or otherwise, find the total amount earned by Peter from the start of 2005 up to the end 2015.

The first three terms of an arithmetic sequence are 2, 8, 14

(i) Find T_n, the nth term of the sequence

(ii) How many terms of the sequence are less than 150?   *(DEB MOCK 2016)*