PiXL Independence:

Mathematics – Student Booklet

KS4 FOUNDATION

Topic 2 – Powers and Roots. HCF/LCM. Ratio/Proportion

Contents:

I.   **Basic Skills Check**

Answer the following questions. In order to improve your basic arithmetic you should attempt these without a calculator.
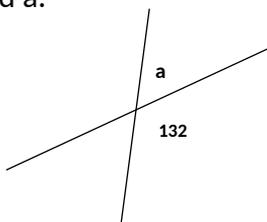
Skills Check 1

1. What is the product of 13 and 21?

2. The price of a 4 pack of beans is reduced by 12%, the original price was £1.50. What is the new price?

3. Write down three factors of 20.

4. Which of these numbers are prime?
    3, 5, 6, 8, 12

5. Simplify 7J + 9k − 3k + 4J

6. Solve: $5x - 3 = 12$

7. Find a.

8. In a class of 30 students 1/6th of the class are left handed. How many are left handed?

9. Expand the bracket 5(a-8).

10. In a quadrilateral the angles are 132^0, 42^0, 110^0 and A. Find the value of A.

Skills Check 2

1. An electricity bill is £87 plus VAT at 5%. Calculate the VAT charged.

2. A bunch of flowers priced at £12, is reduced by a quarter. What is the new price?

3. Write down all the factors of 48.

4. Round 7850 to one significant figure.

5. Simplify 3x + 4y + 2x – 5y.

6. Solve: 5p + 6 = -4.

7. Find A.
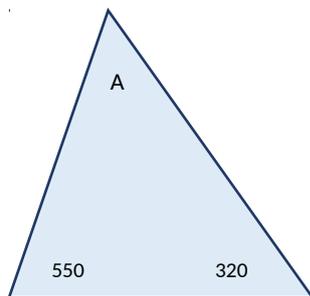
8. In a class of 24 students the probability that a pupil has brown eyes is 1/6th. How many students do not have brown eyes?

9. Expand and simplify 3(a+4) +2(a-3).

10.   Find the next two terms in the sequence; 5, 7, 9, 11, ...

Skills Check 3

1. A coat costs £65, delivery costs a further 5%. What is the delivery charge?

2. A train ticket that costs £126 is reduced by a 1/3. What is the new cost?

3. Find the highest common factor (HCF) of 12 and 40.

4. Round 1.3152 to two significant figures

5. Expand 3(7x – 5).

6. Solve: 20 = 5 -3x.

7. FindB.

    B

    600   600
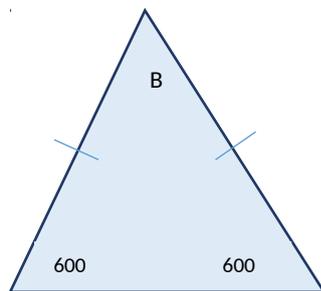
8. In a packet of 20 sweets 6 are red. You take a sweet without looking; what is the probability of choosing a red sweet?

9. Calculate $\frac{2}{5}+\frac{1}{4}$.

10. Find the next two terms in the sequence; 22, 27, 32, 37,..........

II.   Short Exam Questions

Section 1 - Powers and Roots

1. Work out 3.7_2.

2. Work out the cube of 4.

3. Work out $3 \div 0.7^2$ Write down the full calculator display.

4. Use your calculator to work out $\sqrt{\dfrac{39231}{27.9^2}}$

   Write down the full calculator display.

5. Use the x^y button on your calculator to work out:

   a) 13^3 b) 10^0 c) 8^{-1}

6. Use your calculator to find the values of

   (a) $\dfrac{4.75}{3.21 \times 5.76}$. Write down all the figures on your calculator.

   (b) $\sqrt{10 - \pi}$

          (i) Write down all the figures on your calculator.

          (ii) Give your answer to 3 significant figures.

7. Calculate $(3.24 \times 10^{-2}) \times (2.4 \times 10^3)$.

   Give your answer in standard form.

8. Simplify these expressions, giving your answer in index form.

a) $5^6 \times 5^2$ b) $3^7 \div 3^5$ c) $9^3 \times 9^5 \div 9^2$ d) $\dfrac{2^6 \times 2^5}{2^8}$

9. Simplify, <u>leaving in index form</u>:

a) $(3^2)^3$ b) $(5^3)^2$ c) $(4^{-2})^3$ d) $(7^{-4})^2$

<u>Section 2 - HCF/LCM</u>

1. Write down all the factors of 24.

2. Explain why 73 is not a multiple of 3.

3. Write down all the common factors of 16 and 36.

4. Ben thinks the lowest common multiple of 6 and 10 is 60. Is he correct?

5. Find the highest common factor of 20 and 30.

6. Drummers hit their drums on certain beats. Drummer A hits his drum every 6 seconds. Drummer B hits his drum every 7 seconds. In the first 60 seconds, will they ever play at the same time?

7. Are these correct? If not correct them.
   a) HCF of 21 and 28 is 7.   b) HCF of 27 and 45 is 5. c) HCF of 28 and 16 is 8.

8. a) Write 48 and 120 in prime factor form.
   b) Use your answers to find their highest common factor.

9. As a product of prime factors $60 = 2^2 \times 3 \times 5$.
   a) What number is represented by $2 \times 3^2 \times 5$?
   b) Find the lowest common multiple of 60 and 48.

10. Tom, Sam and Matt are counting drum beats.
    Tom hits a snare drum every 2 beats.
    Sam hits a kettle drum every 5 beats.
    Matt hits a bass drum every 8 beats.

    Will they ever play at the same time during 60 beats?

    Show clearly how you get your answer.

Section 3 - Ratio

1.   Simplify the following ratios:

3:9	4:48	3:27	5:125
2:14	3:81	2:6:18	4:14:8

2.   Write these ratios in the form 1:n

2:5	3:8	5:12	3:4
5:9	6:2	4:2	12:7

3.   A school collected £180 for charity. The money was divided between NSPCC and
      RSPCA in the ratio 2:3. How much did each charity receive?

4.   Pocket money is split between Pete, Alan and Helen in the ratio 4:5:6. Dad pays out
      £60. How much does each person get?

5.   Mr Allen, Mrs Book and Ms Collins own 3, 4 and 5 parts of a publishing business. They
      make £120 profit each week. How much do they each receive?

5.   Divide £5 between Bill, Sue and Lucy in the ratio 2:3:5. How much does each person
      get? How much more than the others does Lucy receive?

6.   5 orange drinks cost £6.00. What is the cost of 10 orange drinks?

7.   There are 3 feet in 1 yard. How many feet are in 5 yards?

8.   A recipe for 'flan de naranja' serves 4 and uses:

              275g caster sugar
              200ml orange juice
              7 egg yolks

        I am planning a party for 10 people. How much orange juice will I need to buy?

Section 4 – Mixed Questions

1. Pete Finnegan works on Saturdays and is paid £33 for 6 hours. How much would he be
    paid for working 6 hours on Saturday and 4 hours on Sunday?

2. There are 16 pints in 2 gallons. How many pints are there in 5 gallons?

3. A 250g serving of breakfast cereal contains 450 Kcal. What is the number of Kcal in every
    100g?

4. Andrew went on holiday and had £400 to change into euros (€). The exchange rate was
    £1 = €1.50. How many euros did he have to spend?

5. Using the fact that 1.6 km = 1 mile:

        a) How many kilometres are there in 25 miles?
        b) How many miles are there in 3200 km?

6. Asif scores 32 out of 40 in his Maths test and 81% in his English test.
     In which test does he do better. Show your working.

7. The ratio of the length of a car to a lorry is 2:5.
    The car has a length of 400cm.

    Express the length of the car as a percentage of the length of the lorry.

    Calculate the length of the lorry.

8. Three litres of diesel costs £2.82. What is the cost of 40 litres?

9. 300 grams of sweets cost £1.65. Find the cost of

    a) 100 grams of sweets.
    b) 500 grams of sweets.
    c) 5 kg of sweets.
    Why might your answer to (c) be unrealistic?

10. a) Elana is paid £12.50 per hour. She is given a pay rise of 20%. What is her new pay
       rate?
    b) Six months later, due to adverse economic conditions Elana is asked to take a 20% pay

    cut.
    What will be her hourly rate now?

III.   Further Practice

1. Match the correct people using the information given. Check your answer at the end.

    https://justmaths.co.uk/Worksheets/Number/Factors%20multiples%20and%20primes%20-%20WORKSHEET.pdf

    https://justmaths.co.uk/Worksheets/Number/Factors%20multiples%20and%20primes%20-%20ANSWERS.pdf

2. Look at the worked example from a previous exam paper. Then use the traffic light questions to see where you are.

    https://justmaths.co.uk/Worksheets/Algebra/Laws%20of%20Indices%20-%20Mar%202013%20Non%20Calc%20-%20Q9%20-%20Wsheet.pdf

    CONNECT 4. Print off the sheet and play against another person (you can do this on your own if you don't have a partner)
    https://justmaths.co.uk/ratio-proportion/

    https://justmaths.co.uk/Worksheets/Number/Fractional%20and%20negative%20indices%20-%20connect%204.pdf

3. **Read the information carefully.** Has the bill been calculated correctly? If not, what should it be? What mistakes have they made? You should write a letter of complaint to the garage explaining what they have miscalculated.

    https://justmaths.co.uk/Worksheets/Number/Functional%20Skills%20-%20GARAGE%20PRICING%20TASK.pdf

4. **Ratio hunt.** Download the PDF document and attempt the challenge.

   https://www.teachmathematics.net/page/18949/equivalent-ratio-hunt

5. **Follow the 'revise, activity, test'.** For each of the three topics the links to the 'revise' part are below. You might want to take screen shots, or make notes as you go to demonstrate how you have got on. Then carry out the activity and the test. Record your score, or try and improve.

   http://www.bbc.co.uk/schools/gcsebitesize/maths/number/ratiosrev1.shtml

   http://www.bbc.co.uk/schools/gcsebitesize/maths/number/primefactorsrev1.shtml

   http://www.bbc.co.uk/schools/gcsebitesize/maths/number/primefactorsrev1.shtml

6. **Exam style practice.** For each of the three topics you should watch the video, then answer the exam questions and mark your answers. Where have you made mistakes? Is there something you need to do more work on?

   Powers
   http://www.mathsgenie.co.uk/squares-cubes-and-roots.html
   http://www.mathsgenie.co.uk/resources/6_powers-and-squareroots.pdf
   http://www.mathsgenie.co.uk/resources/6_powers-and-squarerootsans.pdf

   Ratio
   http://www.mathsgenie.co.uk/ratio.html
   http://www.mathsgenie.co.uk/resources/28_ratio.pdf
   http://www.mathsgenie.co.uk/resources/28_ratioans.pdf

   HCF/LCM
   http://www.mathsgenie.co.uk/HCFLCM.html
   http://www.mathsgenie.co.uk/resources/52_hcf-lcm-product-of-primes.pdf
   http://www.mathsgenie.co.uk/resources/52_hcf-lcm-product-of-primesans.pdf

7. **Watch the video and make notes on the questions.**

   https://corbettmaths.com/2012/08/20/powers-indices/

8. **Answer all the questions, keep creating a new worksheet until you get full marks.**
   https://corbettmaths.com/2012/08/20/powers-indices/

IV.   Investigations

For each of the following you should carry out the investigations then read the notes. You need to keep a detailed summary of what methods/approaches you have tried and what you then changed each time.

1. Pick one of the investigations in the booklet and answer the questions. In order to gain full credit you need to extend your investigation further.

   http://social.ocr.org.uk/files/ocr/Maths%20investigations.pdf

2. NRICH activities. Follow the instructions, can you extend your thinking further? Follow some of the links? Keep notes of what you are doing at each stage. Some of the puzzles have links for you to follow to extend or enrich your understanding. If you do follow the links and carry out any further tasks, make sure you keep detailed notes so you can gain extra credit!

   https://nrich.maths.org/6745
   https://nrich.maths.org/5759
   https://nrich.maths.org/11638
   https://nrich.maths.org/7132

3. Exploring maths. Can you find a strategy to win the games? Write a report on how to win for each of the games.

   https://wild.maths.org/got-it
   https://wild.maths.org/approaching-midnight
   https://wild.maths.org/seven-counters

V.   Academic Reading

Maths in the real world.

For each video or article, you should make notes and questions you would like answering to extend your understanding and knowledge of maths in the real world.

1. Follow the **'WATCH, THINK, DIG DEEPER, DISCUSS'**
   The Rubix Cube.

   https://ed.ted.com/featured/VvOg8aiS

2. Follow the **'WATCH, THINK, DIG DEEPER, DISCUSS'**
   Can you find the next number?

   https://ed.ted.com/lessons/can-you-find-the-next-number-in-this-sequence-alex-gendler

3. Follow the **'WATCH, THINK, DIG DEEPER, DISCUSS'**
   Cake!

   https://ed.ted.com/featured/KTil2Gft

4. Read the following article, can you produce a poster, or presentation using this article. **Should maths be taught to all students until they are 18?** What do you think? Can you research arguments for and against?
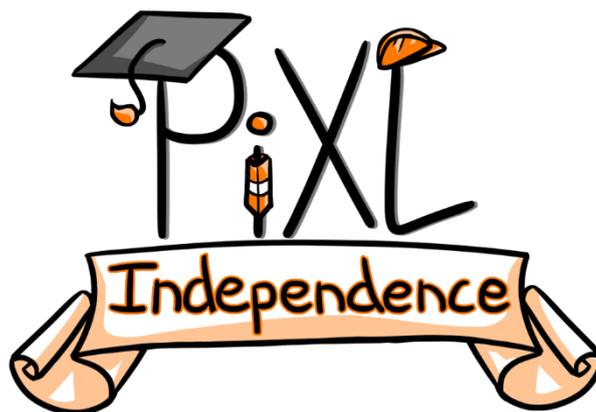
   https://www.theguardian.com/commentisfree/2012/jul/25/compulsory-maths-lessons-until-18
   https://sfh10.wordpress.com/2010/10/25/should-maths-in-secondary-schools-be-compulsory/

5. **Mental multiplication tricks.**
   Watch the video then design instructions to explain how these methods work.

   https://www.youtube.com/watch?v=30X37X1uk2o

Commissioned by The PiXL Club Ltd.