Armadale Academy

National 5 Maths
Revision Booklet

How to use this booklet:

There are practice questions for each of the topics that will be included in your National 5 Maths prelim.

Next to each set of questions is a QR code which you can scan with your phone.

These QR codes will take you videos with explanations of how to answer the questions if you are unsure.

1. Rounding

<u>Rounding to Decimal Places</u>

1. Round the following to 1 decimal place

(a) 4.82   (b) 6.19   (c) 9.77   (d) 10.63   (e) 21.41   (f) 3.14   (g) 48.18

(h) 29.26   (i) 80.85   (j) 0.43   (k) 248.38   (l) 637.51   (k) 62.89   (l) 9.99

2. Round the following to 2 decimal places

(a) 3.487   (b) 2.613   (c) 1.984   (d) 10.046   (e) 8.155

(f) 19.367   (g) 3.141   (h) 6.0698   (i) 4.26317   (j) 93.46197

3. Round the following to 3 decimal places

(a) 0.0346   (b) 6.7568   (c) 4.2251   (d) 1.7583

(e) 40.48546   (f) 128.01891   (g) 0.5059802   (h) 384.456094

<u>Rounding to Significant Figures</u>

Question 1:   Round each of the following numbers to 1 significant figure

(a) 36   (b) 22   (c) 83   (d) 68   (e) 97   (f) 120   (g) 519

(h) 260   (i) 741   (j) 888   (k) 408   (l) 650   (m) 148   (n) 972

(o) 3900   (p) 5400   (q) 4125   (r) 2732   (s) 6349   (t) 8099   (u) 6499

Question 2:   Round each of the following numbers to 1 significant figure

(a) 12000   (b) 46000   (c) 74500   (d) 83771   (e) 95120   (f) 330000

(g) 863000   (h) 248220   (i) 489331   (j) 13800000

Question 3:   Round each of the following numbers to 1 significant figure

(a) 2.9   (b) 3.2   (c) 5.7   (d) 46.81   (e) 57.25   (f) 80.96   (g) 94.9

(h) 115.1   (i) 8.482   (j) 13.65   (k) 66.321   (l) 5501.4   (m) 48.02   (n) 99.99

Question 4:   Round each of the following numbers to 1 significant figure

(a) 0.54   (b) 0.86   (c) 0.161   (d) 0.048   (e) 0.0943   (f) 0.0071   (g) 0.0038

(h) 0.06482   (i) 0.8835   (j) 0.00064   (k) 0.00098   (l) 0.00002789

Question 5:   Round each of the following numbers to 2 significant figures

(a) 844   (b) 665   (c) 129   (d) 2840   (e) 9250   (f) 1359   (g) 298

(h) 504   (i) 999   (j) 3841   (k) 48500   (l) 13.7   (m) 58.3   (n) 49.6

(o) 1.41   (p) 42.64   (q) 0.3189   (r) 22490   (s) 186110   (t) 0.04912   (u) 4.98

(v) 997826   (w) 2.99517   (x) 0.06014

Question 6: Round each of the following numbers to 3 significant figures

(a) 9433   (b) 1891   (c) 2496   (d) 3.226   (e) 37756   (f) 57147   (g) 7.0078

(h) 51.564   (i) 0.90341   (j) 2.7892   (k) 0.08906   (l) 0.007812   (m) 9909.1   (n) 0.6006

2. Fractions

Converting between Mixed Numbers and Improper Fractions

1. Change the following from an improper fraction to a mixed number

(a) $\dfrac{7}{3}$ (b) $\dfrac{7}{5}$ (c) $\dfrac{5}{2}$ (d) $\dfrac{8}{7}$ (e) $\dfrac{5}{3}$

(f) $\dfrac{10}{3}$ (g) $\dfrac{23}{2}$ (h) $\dfrac{11}{4}$ (i) $\dfrac{11}{8}$ (j) $\dfrac{9}{4}$

(k) $\dfrac{13}{10}$ (l) $\dfrac{13}{6}$ (m) $\dfrac{16}{7}$ (n) $\dfrac{51}{10}$ (o) $\dfrac{34}{11}$

Converting Improper Fractions and Mixed Numbers

2. Change the following from a mixed numbers to an improper fraction

(a) $2\dfrac{1}{5}$ (b) $3\dfrac{1}{2}$ (c) $1\dfrac{3}{4}$ (d) $3\dfrac{2}{3}$ (e) $1\dfrac{2}{5}$

(f) $2\dfrac{4}{7}$ (g) $1\dfrac{1}{3}$ (h) $2\dfrac{3}{10}$ (i) $4\dfrac{3}{4}$ (j) $1\dfrac{7}{12}$

(k) $3\dfrac{9}{10}$ (l) $2\dfrac{3}{50}$ (m) $3\dfrac{5}{8}$ (n) $8\dfrac{3}{8}$ (o) $1\dfrac{14}{32}$

Adding and Subtracting Fractions

1. Calculate the following, give your answers in their simplest form

(a) $\dfrac{2}{5}+\dfrac{1}{2}$ (b) $\dfrac{2}{7}+\dfrac{1}{2}$ (c) $\dfrac{1}{3}+\dfrac{1}{2}$ (d) $\dfrac{4}{5}-\dfrac{2}{3}$

(e) $\dfrac{8}{9}-\dfrac{1}{3}$ (f) $\dfrac{2}{3}+\dfrac{1}{6}$ (g) $\dfrac{3}{10}+\dfrac{2}{5}$ (h) $\dfrac{3}{8}+\dfrac{1}{4}$

Adding and Subtracting Fractions

2. Calculate the following, give your answers in their simplest form

(a) $1\dfrac{1}{2}+\dfrac{2}{3}$ (b) $\dfrac{7}{9}+1\dfrac{1}{3}$ (c) $1\dfrac{3}{5}-\dfrac{3}{4}$ (d) $1\dfrac{5}{8}-1\dfrac{1}{4}$

(e) $2\dfrac{1}{2}+1\dfrac{1}{3}$ (f) $2\dfrac{2}{9}-1\dfrac{1}{3}$ (g) $2\dfrac{2}{9}+\dfrac{5}{6}$ (h) $1\dfrac{5}{12}+1\dfrac{5}{8}$

(i) $3\dfrac{1}{10}+2\dfrac{2}{3}$ (j) $1\dfrac{8}{9}-\dfrac{4}{7}$ (k) $3\dfrac{2}{3}-1\dfrac{11}{20}$ (l) $4\dfrac{8}{15}+3\dfrac{1}{3}$

Multiplying Fractions

1. Calculate the following, give your answers in their simplest form

(a) $\dfrac{1}{2} \times \dfrac{1}{5}$ (b) $\dfrac{1}{2} \times \dfrac{3}{4}$ (c) $\dfrac{1}{4} \times \dfrac{3}{5}$ (d) $\dfrac{1}{3} \times \dfrac{1}{3}$

(e) $\dfrac{5}{6} \times \dfrac{1}{2}$ (f) $\dfrac{3}{4} \times \dfrac{1}{4}$ (g) $\dfrac{2}{3} \times \dfrac{1}{7}$ (h) $\dfrac{5}{8} \times \dfrac{1}{3}$

2. Calculate the following, give your answers in their simplest form

(a) $1\dfrac{2}{3} \times \dfrac{1}{4}$ (b) $\dfrac{2}{5} \times 1\dfrac{1}{4}$ (c) $\dfrac{3}{4} \times 1\dfrac{1}{2}$ (d) $2\dfrac{1}{2} \times \dfrac{7}{10}$

(e) $\dfrac{1}{4} \times 3\dfrac{1}{3}$ (f) $1\dfrac{2}{3} \times 1\dfrac{1}{4}$ (g) $4\dfrac{3}{5} \times 1\dfrac{2}{3}$ (h) $1\dfrac{2}{11} \times \dfrac{8}{9}$

(i) $2\dfrac{5}{6} \times 2\dfrac{1}{5}$ (j) $1\dfrac{1}{9} \times 3\dfrac{3}{10}$ (k) $3\dfrac{1}{8} \times 2\dfrac{1}{2}$ (l) $2\dfrac{6}{7} \times 3\dfrac{1}{5}$

Dividing Fractions

1. Calculate the following, give your answers in their simplest form

(a) $\dfrac{1}{5} \div \dfrac{2}{3}$ (b) $\dfrac{3}{4} \div \dfrac{4}{5}$ (c) $\dfrac{1}{2} \div \dfrac{7}{8}$ (d) $\dfrac{2}{3} \div \dfrac{5}{6}$

(e) $\dfrac{1}{10} \div \dfrac{4}{9}$ (f) $\dfrac{6}{11} \div \dfrac{5}{6}$ (g) $\dfrac{2}{5} \div \dfrac{13}{15}$ (h) $\dfrac{3}{8} \div \dfrac{7}{9}$

2. Calculate the following, give your answers in their simplest form

(a) $\dfrac{2}{3} \div 1\dfrac{4}{5}$ (b) $1\dfrac{1}{2} \div 1\dfrac{9}{10}$ (c) $2\dfrac{3}{7} \div \dfrac{1}{2}$ (d) $2\dfrac{1}{3} \div 5\dfrac{1}{2}$

(e) $3 \div 2\dfrac{1}{8}$ (f) $4\dfrac{1}{3} \div 2\dfrac{9}{10}$ (g) $6\dfrac{5}{6} \div 2$ (h) $1\dfrac{5}{12} \div 2\dfrac{2}{11}$

3. Percentages

Compound Interest

Question 1:   Paul leaves £4000 in the bank for two years.
It earns compound interest of 5% per year.
Calculate the total amount Paul has in the bank at the end of the two years.

Question 2:   The population of birds on an island is estimated to increase by 10% every year.
The population of birds on the island is 20000.
Calculate an estimate for the population of birds in three years time.

Question 3:   The value of a car decreases by 5% each year.
Sophie bought a car two years ago for £10000
Work out the value now.

Question 4:   Sam invests £1800 in the bank for four years.
It earns compound interest of 4% each year.
Calculate the total amount Sam has in the bank at the end of four years.

Question 5:   A full water tank holds 500 litres.
The tank begins to leak water and is losing 14% of its contents every hour.
Find how much water is left in the tank after 8 hours.

Question 6:   The height of a tree increases by 60% each year.
When planted the tree was 40cm tall.
How tall will the tree be in 5 years time.

Question 7:   Carrie invests £800 for 4 years at 3% interest per year.
How much interest does she earn?

Question 8:   A house was bought for £100,000
Its value appreciates by 7.5% each year for the first three years.
What was its value at the end of the three years?

Question 9:   The number of people living on a remote island decreases by 9% every 10 years.
In 1950 there were 18000 living on the island.
Calculate how many less people will be living on the island in 2020.

Question 10: A car was bought for £20,000.
Its value depreciates by 31% each year for the first four years.
What is its values at the end of the four years?

Question 11: A tree is 80cm when planted.
Each year the height of the tree increases by 22%.
After how many complete years will the height of tree be at least 3m?

Question 12: The number of polar bears in a region is decreasing by 5% per year.
There are 3000 polar bears in the region in 2017.
What year will be the first year with less than 1000 polar bears in the region?

Question 13: Michael has started working for a company on a salary of £15000.
Each year he will be given a 6% pay rise.
How many years will it take for Michael's salary to exceed £30000?

Question 14: The value of a car decreases by 7.2% each year.
When bought the car cost £6200.
How many years will it take the car to have a value less than £1000?

Reverse Percentages

Question 1:   20% of all the children in a class are left handed.
4 children are left handed.
How many children are there in the class altogether?

Question 2:   30% of the members of a tennis club are pensioners.
36 members are pensioners.

(a) How many members are there in total?
(b) How many members are not pensioners?

Question 3:   A group of people sit their driving theory test and 24 people passed.
80% of the people passed the driving theory test.
How many people sat the test altogether?

Question 4:   An energy bar contains 2.1g of protein.
6% of the bar is protein.
What is the total mass of the bar?

Question 5:   Swansea is a city in Wales.
The population of Swansea is 240,000
This population is 7.5% of the total population of Wales.
What is the total population of Wales?

Question 6:   Heather invested money into a savers bank account.
Each year the money in the account earns 10% interest.
After one year, the total amount of money in the account was £2200
How much did Heather invest?

Question 7:   A chair is on sale at a price of £20.80
This is a 20% reduction of the normal price.
What was the price of the chair before the reduction?

Question 8: The population of an island has decreased by 40% over 50 years.
The population in 2018 was 360
What was the population in 1968?

Question 9: Sinead buys a watch.
20% VAT is added to the price of the watch.
Sinead then has to pay a total of £60
What is the price of the watch with no VAT added?

Question 10: Lucy has 68 books.
This number of books is 70% more than the number of books she had last year.
How many books did Lucy have last year?

Question 11: Henry invested money into a bank account.
Each year the money in the account earns 3% interest.
After one year, the total amount of money in the account was £169.95
How much did Henry invest?

Question 12: In a sale, the price of lawnmowers are decreased by 16%
Jude buys a lawnmower in the sale for £369.60
How much was the lawnmower before the sale?

Question 13: Evie is given a 22% pay rise.
Her new salary is £21960
What was Evie's salary before the pay rise?

4. Surds

Simplifying Surds

1. Simplify the following surds

(a) $\sqrt{8}$ (b) $\sqrt{75}$ (c) $\sqrt{20}$ (d) $\sqrt{32}$ (e) $\sqrt{48}$ (f) $\sqrt{200}$

(g) $\sqrt{300}$ (h) $\sqrt{80}$ (i) $\sqrt{50}$ (j) $\sqrt{98}$ (k) $\sqrt{63}$ (l) $\sqrt{800}$

(m) $\sqrt{180}$ (n) $\sqrt{220}$ (o) $\sqrt{96}$ (p) $\sqrt{175}$ (q) $\sqrt{1000}$ (r) $\sqrt{60}$

Introduction to Surds including Simplifying

2. Simplify the following surds

(a) $5\sqrt{8}$ (b) $2\sqrt{20}$ (c) $4\sqrt{50}$ (d) $3\sqrt{98}$ (e) $15\sqrt{32}$ (f) $10\sqrt{75}$

Adding and Subtracting Surds

1. Simplify the following

(a) $\sqrt{8} + \sqrt{18}$ (b) $\sqrt{50} + \sqrt{8}$ (c) $\sqrt{75} + \sqrt{27}$ (d) $\sqrt{200} - \sqrt{32}$

(e) $\sqrt{8} + \sqrt{2} + \sqrt{72}$ (f) $\sqrt{300} - \sqrt{48}$ (g) $\sqrt{1000} + \sqrt{90}$ (h) $\sqrt{28} + \sqrt{63}$

Adding and Subtracting Surds

2. Simplify the following

(a) $3\sqrt{8} + \sqrt{2}$ (b) $4\sqrt{27} - \sqrt{75}$ (c) $2\sqrt{50} + 5\sqrt{32}$ (d) $\sqrt{200} - 3\sqrt{18}$

(e) $4\sqrt{80} + 3\sqrt{45}$ (f) $6\sqrt{75} - 2\sqrt{12}$ (g) $10\sqrt{7} + 2\sqrt{175}$

Rationalising the Denominator

1. Express the following with a rational denominator

(a) $\dfrac{2}{\sqrt{3}}$ (b) $\dfrac{5}{\sqrt{2}}$ (c) $\dfrac{7}{\sqrt{6}}$ (d) $\dfrac{1}{\sqrt{10}}$

(e) $\dfrac{4}{\sqrt{2}}$ (f) $\dfrac{9}{\sqrt{6}}$ (g) $\dfrac{\sqrt{2}}{\sqrt{3}}$ (h) $\dfrac{3}{2\sqrt{5}}$

Rationalising the Denominator

5. Indices

Laws of Indices

Question 1:   Write as a single power of 2.

(a) $2^2 \times 2^2$ (b) $2^2 \times 2^3$ (c) $2^6 \times 2^2$ (d) $2^4 \times 2^3$ (e) $2^6 \times 2^8$ (f) $2^2 \times 2$ (g) 2×2^4

(h) $2^8 \times 2^8$ (i) $2^9 \times 2^2$ (j) 2×2^8 (k) $2^6 \times 2^5$ (l) $2^2 \times 2^2 \times 2^2 \times 2^2$

Laws of Indices

Question 2:   Write as a single power of 5.

(a) $5^5 \div 5^2$ (b) $5^8 \div 5^3$ (c) $5^9 \div 5^2$ (d) $5^7 \div 5^5$ (e) $5^3 \div 5$ (f) $5^8 \div 5$ (g) $5^7 \div 5^4$

(h) $5^9 \div 5^3$ (i) $5^4 \div 5^8$ (j) $5 \div 5^3$ (k) $5^{45} \div 5^5$ (l) $5^3 \div 5^3$

Question 3:   Write as a single power of 3.

(a) $\dfrac{3^5}{3^2}$ (b) $\dfrac{3^{10}}{3^5}$ (c) $\dfrac{3^8}{3^3}$ (d) $\dfrac{3^{20}}{3^5}$

(e) $\dfrac{3^7}{3^7}$ (f) $\dfrac{3^2}{3^4}$ (g) $\dfrac{3^{15}}{3^9}$ (h) $\dfrac{3^3}{3^8}$

Question 4:   Write as a single power of 8.

(a) $(8^5)^2$ (b) $(8^3)^2$ (c) $(8^4)^3$ (d) $(8^5)^4$ (e) $(8^3)^6$ (f) $(8^7)^3$ (g) $(8^6)^6$

(h) $(8^9)^2$ (i) $(8^4)^8$ (j) $(8^3)^{-5}$ (k) $(8^{-5})^2$

Question 5:   Write as a single power of y.

(a) $y^7 \times y^3$ (b) $y^9 \div y^7$ (c) $y^6 \div y^2$ (d) $(y^3)^5$ (e) $y^7 \div y$ (f) $y^3 \div y^7$ (g) $(y^9)^5$

(h) $y^6 \times y^7$ (i) $y^6 \times y^5 \times y^2$ (j) $y^8 \times y \times y^3$ (k) $\dfrac{y^8}{y^5}$

Negative Indices

Question 1: Evaluate each of the following

(a) 5^{-2} (b) 2^{-1} (c) 2^{-3} (d) 4^{-2} (e) 3^{-3} (f) 6^{-1}

(g) 10^{-2} (h) 2^{-4} (i) 9^{-2} (j) 3^{-4} (k) 10^{-1} (l) 7^{-2}

(m) 2^{-5} (n) 5^{-3} (o) 2^{-6} (p) 10^{-4} (q) 6^{-3} (r) 10^{-6}

Question 2: Write each of the following in index form.

(a) $\dfrac{1}{5^2}$ (b) $\dfrac{1}{3^4}$ (c) $\dfrac{1}{8^3}$ (d) $\dfrac{1}{4^5}$ (e) $\dfrac{1}{10^3}$ (f) $\dfrac{1}{2^6}$

Fractional Indices

1. Evaluate each of the following

(a) $25^{\frac{1}{2}}$ (b) $81^{\frac{1}{2}}$ (c) $4^{\frac{1}{2}}$ (d) $144^{\frac{1}{2}}$ (e) $8^{\frac{1}{3}}$ (f) $125^{\frac{1}{3}}$

(g) $100^{\frac{1}{2}}$ (h) $1000^{\frac{1}{3}}$ (i) $49^{\frac{1}{2}}$ (j) $225^{\frac{1}{2}}$ (k) $64^{\frac{1}{2}}$ (l) $27^{\frac{1}{3}}$

(m) $216^{\frac{1}{3}}$ (n) $64^{\frac{1}{3}}$ (o) $16^{\frac{1}{4}}$ (p) $1^{\frac{1}{4}}$ (q) $81^{\frac{1}{4}}$ (r) $625^{\frac{1}{4}}$

2. Evaluate each of the following

(a) $9^{\frac{3}{2}}$ (b) $4^{\frac{3}{2}}$ (c) $8^{\frac{2}{3}}$ (d) $27^{\frac{2}{3}}$ (e) $125^{\frac{2}{3}}$ (f) $49^{\frac{3}{2}}$

(g) $4^{\frac{5}{2}}$ (h) $64^{\frac{2}{3}}$ (i) $9^{\frac{5}{2}}$ (j) $100^{\frac{3}{2}}$ (k) $16^{\frac{3}{2}}$ (l) $1000^{\frac{2}{3}}$

(m) $100^{\frac{5}{2}}$ (n) $32^{\frac{2}{5}}$ (o) $4^{\frac{7}{2}}$ (p) $8^{\frac{5}{3}}$ (q) $16^{\frac{3}{4}}$ (r) $81^{\frac{3}{4}}$

(s) $32^{\frac{3}{5}}$ (t) $27^{\frac{5}{3}}$ (u) $64^{\frac{5}{6}}$ (v) $10000^{\frac{3}{4}}$

6. Scientific Notation (Standard Form)

Writing a number in Scientific Notation

1. Write the following in Scientific Notation

(a) 40000 (b) 2000000 (c) 8000000 (d) 7000

(e) 100000000 (f) 900 (g) 250000 (h) 1900

(i) 54000000 (j) 11000000 (k) 89000 (l) 3600000000

2. Write the following in Scientific Notation

(a) 0.002   (b) 0.0005   (c) 0.9   (d) 0.00000004

(e) 0.00065   (f) 0.0022   (g) 0.0361   (h) 0.000558

(i) 0.00000423   (j) 0.0000000981   (k) 0.00407   (l) 0.02052

Calculations involving Scientific Notation

Question 1: The distance between London and New York is 5,567,000 metres. Write this number in standard form.

Question 2: The distance from the Sun to Pluto is 3.67 billion miles. Write this number in standard form.

Multiplying in Standard Form

Question 3: The length of a cell is 0.016 mm Write this number in standard form.

Question 4: The population of a country is 6.51×10^5 Write the population of the country as an ordinary number.

Dividing in Standard Form

Question 5: 32,010 people attend a football match between West Ham and Southampton. Write this number in standard form.

Question 6: There are approximately 5×10^4 grains of rice in a one kilogram bag of rice. Approximately how many grains of rice will be in 20 one kilogram bags of rice?

Question 7: A penny weighs 0.0036kg. Find the total mass of £400 worth of pennies.

Question 8: $A = 6 \times 10^5$ $B = 30000$ $C = 5 \times 10^{-2}$
(a) Work out AB
(b) Work out C^2

Question 9: The population of the United Kingdom in 1950 was 5.06×10^7
The population of the United Kingdom in 2015 was 6.47×10^7
Work out how many more people live in the United Kingdom in 2015 than 1950.
Give your answer as an ordinary number.

Question 10: Peter has multiplied two numbers using his calculator.
The calculator shows the answer.
He can remember that one number was 5000.
What was the other number used in the multiplication?
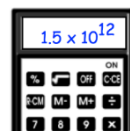
7. Expanding Brackets

<u>Expanding Single Brackets</u>

1. Expand the following

(a) $5(y + 3)$ (b) $4(a + 2)$ (c) $8(w + 10)$ (d) $3(x - 7)$

(e) $9(s - 1)$ (f) $2(8 - t)$ (g) $7(4 + h)$ (h) $10(a + 2b + 3c)$

(i) $4(3y + 2)$ (j) $5(2p - 1)$ (k) $3(7a + 2)$ (l) $9(2x - 5)$

2. Expand the following

(a) $-2(w + 5)$ (b) $-3(c + 7)$ (c) $-8(c + 7)$ (d) $-10(y - 2)$

(e) $-7(g - 3)$ (f) $-4(2w + 3)$ (g) $-9(3w - 5)$ (h) $-9(5x - 1)$

(i) $-5(6 - c)$ (j) $-6(4 + 3m)$ (k) $-2(1 + 9c)$ (l) $-5(8a - 7w)$

3. Expand and simplify

(a) $5(y + 3) + 2(y + 7)$ (b) $6(2w + 5) + 9(w + 2)$ (c) $3(y - 2) + 4(2y + 5)$

(d) $7(2g + 3) - 5(g + 2)$ (e) $6(x - 2) - 4(x - 8)$ (f) $2(3y - 8) - 5(2y - 1)$

(g) $8(5 + 2m) + 3(5 - 3m)$ (h) $4(w + 7) - 2(2w + 1)$ (i) $9(1 + 2y) + 3(3 - y)$

<u>Expanding Double Brackets</u>

1. Expand and simplify

(a) $(w + 4)(w + 2)$ (b) $(y + 1)(y + 2)$ (c) $(c + 2)(c + 5)$ (d) $(x + 6)(x + 7)$

(e) $(a + 5)(a - 3)$ (f) $(g + 7)(g - 4)$ (g) $(s - 4)(s + 5)$ (h) $(x + 1)(x - 3)$

(i) $(p - 3)(p - 2)$ (j) $(y - 4)(y - 4)$ (k) $(k - 5)(k - 6)$ (l) $(v + 4)(v + 3)$

2. Expand and simplify

(a) $(2c + 1)(2c + 3)$ (b) $(5x + 1)(2x + 5)$ (c) $(3w + 2)(w + 1)$

(d) $(3p + 2)(2p - 1)$ (e) $(5g - 4)(g + 1)$ (f) $(2a - 3)(4a + 7)$

(g) $(4r - 5)(2r - 3)$ (h) $(2y - 3)(9y - 1)$ (i) $(5k - 4)(2k - 1)$

Expanding Brackets with two/three terms

1. Multiply out the brackets:

(a) $x(x^2 + x - 1)$ **(b)** $3(2x^2 - 3x + 5)$ **(c)** $x(3x^2 - 5x + 8)$

(d) $2x(x^2 + 2x + 3)$ **(e)** $-5(x^2 - 8x + 2)$ **(f)** $x(x^2 - 4x - 7)$

2. Multiply out the brackets and simplify:

(a) $(x + 2)(x^2 + 3x + 1)$ **(b)** $(x + 5)(x^2 + 4x + 2)$ **(c)** $(x + 1)(x^2 + 5x + 4)$

(d) $(x + 3)(x^2 + x + 5)$ **(e)** $(x + 8)(x^2 + 2x + 3)$ **(f)** $(x + 4)(x^2 + 7x + 6)$

(g) $(x + 12)(x^2 + x + 7)$ **(h)** $(x + 10)(x^2 + 3x + 9)$ **(i)** $(x + 9)(x^2 + 12x + 7)$

3. Multiply out the brackets and simplify:

(a) $(x - 1)(x^2 + x + 1)$ **(b)** $(x - 7)(x^2 + 3x + 5)$ **(c)** $(x - 2)(x^2 + 4x + 3)$

(d) $(x - 4)(x^2 + 6x + 1)$ **(e)** $(x - 3)(x^2 - 2x + 5)$ **(f)** $(x - 6)(x^2 - 5x + 2)$

(g) $(x - 4)(x^2 - x + 2)$ **(h)** $(x - 1)(x^2 - 2x + 7)$ **(i)** $(x - 9)(x^2 + 3x - 2)$

4. Multiply out the brackets and simplify:

(a) $(x + 5)(2x^2 + 4x + 9)$ **(b)** $(x - 3)(5x^2 + x + 6)$ **(c)** $(x - 2)(6x^2 - 5x + 7)$

(d) $(x + 7)(3x^2 + 9x - 2)$ **(e)** $(x - 4)(5x^2 - x - 8)$ **(f)** $(x + 1)(7x^2 - 2x + 11)$

(g) $(2x + 1)(3x^2 + 4x + 1)$ **(h)** $(3x + 4)(x^2 - 11x + 2)$ **(i)** $(5x - 2)(2x^2 + 3x - 7)$

5. Expand and simplify each of the following expressions:

(a) $3(x - 4) + (x + 2)^2$ **(b)** $(2x - 1)(x + 3) + 2x(x - 3)$ **(c)** $(2x + 3)^2 - 4(x + 1)$

(d) $-(x + 2)^2 + 4x$ **(e)** $-3(2x - 1)^2 + 12x^2$ **(f)** $(x - 3)(x + 2) - (x + 4)^2$

(g) $3x(x - 4) - (x + 2)(x - 4)$ **(h)** $(x+2)^2 + (2x - 1)^2 - (x + 3)$ **(i)** $(2x - 3)^2 - 4(x - 3)(2x+1)$

(j) $3x(x + 3)^2 + 2x(x - 3)$ **(k)** $2x(x^2 - x + 2) + (x - 3)^2$ **(l)** $(x - 1)^2 - x(x + 1)^2$

8. Factorising

<u>Highest Common Factor</u>

1. Factorise

(a) $4x + 6$ (b) $15x + 20$ (c) $9y - 12$ (d) $5x + 15$

(e) $6x - 3$ (f) $4x + 8$ (g) $5y - 25$ (h) $8w + 24$

(i) $10y + 15$ (j) $14w + 21$ (k) $20y - 30$ (l) $27x + 18$

2. Factorise

(a) $x^2 + 7x$ (b) $x^2 - 3x$ (c) $y^2 + y$ (d) $w^2 + 9w$

(e) $x^2 - 7x$ (f) $4w^2 + 10w$ (g) $6x^2 - 8x$ (h) $9y^2 - 6y$

(i) $10c + c^2$ (j) $5g - g^2$ (k) $14x^2 + 35x$ (l) $40x^2 - 50x$

<u>Difference of Two Squares</u>

Question 1:   Factorise each of the following

(a) $x^2 - 25$ (b) $y^2 - 49$ (c) $w^2 - 100$ (d) $x^2 - 4$

(e) $c^2 - 64$ (f) $x^2 - 1$ (g) $x^2 - 900$ (h) $y^2 - 9$

(i) $16 - x^2$ (j) $1 - y^2$ (k) $81 - x^2$ (l) $144 - h^2$

(m) $x^2 - y^2$ (n) $a^2 - c^2$ (o) $9x^2 - 25$ (p) $4y^2 - 1$

(q) $49x^2 - 16$ (r) $100 - 81x^2$ (s) $9x^2 - 4y^2$ (t) $36a^2 - c^2$

(u) $121w^2 - 196y^2$ (v) $225 - 121y^2$

Question 2:   Factorise **fully** each of the following

(a) $2x^2 - 32$ (b) $2y^2 - 18$ (c) $2x^2 - 200$ (d) $3x^2 - 75$

(e) $5c^2 - 20$ (f) $18x^2 - 2$ (g) $12x^2 - 147$ (h) $20y^2 - 320$

Trinomials

Question 1:   Factorise each of the following

(a) $x^2 + 7x + 12$ (b) $x^2 + 6x + 8$ (c) $x^2 + 5x + 6$ (d) $x^2 + 8x + 7$

(e) $x^2 + 4x + 4$ (f) $x^2 + 8x + 15$ (g) $x^2 + 6x + 9$ (h) $x^2 + 11x + 28$

(i) $x^2 + 10x + 25$ (j) $x^2 + 12x + 20$ (k) $x^2 + 25x + 24$ (l) $x^2 + 11x + 24$

(m) $x^2 + 9x + 14$ (n) $x^2 + 23x + 60$ (o) $x^2 + 29x + 100$ (p) $x^2 + 20x + 51$

Question 2:   Factorise each of the following

(a) $x^2 + x - 12$ (b) $x^2 + 5x - 6$ (c) $x^2 + 3x - 10$ (d) $x^2 + 3x - 4$

(e) $x^2 + 2x - 48$ (f) $x^2 + 4x - 32$ (g) $x^2 + 2x - 35$ (h) $x^2 + 8x - 33$

Question 3:   Factorise each of the following

(a) $x^2 - 3x - 10$ (b) $x^2 - x - 20$ (c) $x^2 - 6x - 27$ (d) $x^2 - 2x - 3$

(e) $x^2 - x - 12$ (f) $x^2 - 4x - 12$ (g) $x^2 - 4x - 21$ (h) $x^2 - 6x - 55$

Question 4:   Factorise each of the following

(a) $x^2 - 6x + 9$ (b) $x^2 - 9x + 20$ (c) $x^2 - 9x + 14$ (d) $x^2 - 13x + 22$

(e) $x^2 - 9x + 8$ (f) $x^2 - 12x + 32$ (g) $x^2 - 15x + 36$ (h) $x^2 - 14x + 48$

Question 5:   Factorise each of the following

(a) $x^2 - 9x + 8$ (b) $x^2 + 24x + 23$ (c) $x^2 - 5x - 14$ (d) $x^2 - 7x + 12$

(e) $x^2 + 12x + 36$ (f) $x^2 - 2x - 63$ (g) $x^2 + 14x + 24$ (h) $x^2 + 17x + 60$

(i) $x^2 - 11x + 30$ (j) $x^2 - 4x - 32$ (k) $x^2 - 2x - 63$ (l) $x^2 - 16x - 17$

(m) $x^2 - 11x + 18$ (n) $x^2 - 13x + 22$ (o) $x^2 + 18x + 56$ (p) $x^2 - 21x + 110$

(q) $x^2 - 16x + 64$ (r) $x^2 + 22x + 121$ (s) $x^2 - x - 72$ (t) $x^2 - 3x - 18$

(u) $x^2 - 4x - 45$ (v) $x^2 - 16x + 63$

Question 6:   Factorise each of the following

(a) $x^2 + 8x - 105$ (b) $x^2 - 18x - 88$ (c) $x^2 - 75x + 350$ (d) $x^2 + 22x + 96$

(e) $x^2 + 25x + 154$ (f) $x^2 - 55x - 300$ (g) $x^2 - 29x + 180$ (h) $x^2 - x - 210$

Non-Unitary x^2 Trinomials

Question 1: Factorise each of the following

(a) $2x^2 + 7x + 5$

(b) $2x^2 + 11x + 15$

(c) $2x^2 + 9x + 10$

(d) $3x^2 + 13x + 4$

(e) $3x^2 + 4x + 1$

(f) $3x^2 + 8x + 4$

(g) $5x^2 + 13x + 6$

(h) $5x^2 + 26x + 5$

(i) $7x^2 + 10x + 3$

(j) $11x^2 + 47x + 12$

(k) $2x^2 + 17x + 36$

(l) $5x^2 + 62x + 24$

Question 2: Factorise each of the following

(a) $3x^2 + x - 4$

(b) $7x^2 + 20x - 3$

(c) $2x^2 - 13x + 15$

(d) $3x^2 - 17x + 10$

(e) $3x^2 - 16x - 12$

(f) $3x^2 - x - 4$

(g) $5x^2 - 13x - 6$

(h) $3x^2 + 8x - 3$

(i) $2x^2 - x - 10$

(j) $2x^2 - 3x - 44$

(k) $7x^2 - 22x + 16$

(l) $2x^2 + 15x - 38$

Method 1

Method 2

9. Quadratics

Completing the Square

Question 1: Write the following expressions in the form $(x + a)^2 + b$

(a) $x^2 + 8x + 1$

(b) $x^2 + 10x + 3$

(c) $x^2 + 2x - 1$

(d) $x^2 - 6x - 10$

(e) $x^2 - 4x - 13$

(f) $x^2 - 12x + 3$

(g) $x^2 + 14x + 3$

(h) $x^2 - 2x - 15$

(i) $x^2 + 4x - 11$

(j) $x^2 + x - 8$

(k) $x^2 + 3x + 1$

(l) $x^2 - 7x - 2$

(m) $x^2 - 9x - 1$

(n) $x^2 + 11x + 3$

(o) $x^2 - 100x - 25$

Completing the Square

Solving by Factorising

Question 1: Solve each of the equations below

(a) $(x - 1)(x - 3) = 0$

(b) $(y - 4)(y - 9) = 0$

(c) $(m + 1)(m + 6) = 0$

(d) $(x - 3)(x + 2) = 0$

(e) $(t + 7)(t - 3) = 0$

(f) $(k - 10)(k + 9) = 0$

(g) $(w + 5)(w + 11) = 0$

(h) $(y - 8)(y - 2) = 0$

(i) $(x + 3)(x - 9) = 0$

Solving by Factorising

Question 2: Solve each of the equations below

(a) $x^2 + 6x + 8 = 0$

(b) $x^2 + 7x + 12 = 0$

(c) $y^2 + 7y + 10 = 0$

(d) $y^2 + 3y - 4 = 0$

(e) $x^2 - 2x - 8 = 0$

(f) $m^2 - 7m + 12 = 0$

(g) $y^2 - 10y + 25 = 0$

(h) $y^2 - 4y - 45 = 0$

(i) $x^2 - x - 56 = 0$

(j) $y^2 + 10y + 24 = 0$

(k) $x^2 + 9x + 18 = 0$

(l) $x^2 + 23x + 22 = 0$

(m) $y^2 - 13y + 22 = 0$

(n) $x^2 + x - 12 = 0$

(o) $m^2 - 6m - 27 = 0$

(p) $x^2 - 11x + 18 = 0$

(q) $y^2 - 14y + 48 = 0$

(r) $x^2 - 15x + 56 = 0$

(s) $m^2 - m - 56 = 0$

(t) $y^2 + 22y + 96 = 0$

(u) $k^2 - 18k - 88 = 0$

Solving using the Quadratic Formula

Question 1: Solve the following equations using the quadratic formula.
Give your answers to 1 decimal place.

(a) $x^2 + 5x + 1 = 0$

(b) $2x^2 + 7x + 2 = 0$

(c) $4x^2 + 8x + 3 = 0$

(d) $x^2 + 2x - 4 = 0$

(e) $3x^2 + 4x - 5 = 0$

(f) $2x^2 + 5x - 10 = 0$

(g) $x^2 - 4x + 2 = 0$

(h) $7x^2 - 6x + 1 = 0$

(i) $3x^2 - 10x + 4 = 0$

(j) $x^2 - x - 11 = 0$

(k) $x^2 - 6x - 20 = 0$

(l) $2x^2 - x - 9 = 0$

(m) $9x^2 - 12x + 2 = 0$

(n) $4x^2 + 4x + 1 = 0$

(o) $8x^2 - 8x - 9 = 0$

(p) $2x^2 + 3x - 100 = 0$

(q) $3x^2 - 23x - 67 = 0$

(r) $2x^2 + 16x + 1 = 0$

Solving using the Quadratic Formula

Finding the Discriminant

1. Find the discriminant for each of these quadratic equations and state the nature of the roots.

(a) $x^2 + 4x + 3 = 0$

(b) $x^2 + 6x + 9 = 0$

(c) $x^2 + 8x + 7 = 0$

(d) $3 - 5w - 2w^2 = 0$

(e) $2x^2 + 7x + 5 = 0$

(f) $x^2 - 12x + 36 = 0$

(g) $x^2 - 7x + 12 = 0$

(h) $2x^2 + 7x + 9 = 0$

(i) $5x^2 - 16x + 3 = 0$

(j) $6y^2 - 11y - 2 = 0$

(k) $x^2 - 8x + 9 = 0$

(l) $3x^2 + 2x + 7 = 0$

(m) $2x^2 - 7x + 4 = 0$

(n) $4x^2 - 3x + 4 = 0$

(o) $3x^2 - 2x - 1 = 0$

(p) $x^2 + 10x + 25 = 0$

(q) $3x^2 - 7x + 5 = 0$

(r) $x^2 - 8x + 16 = 0$

Finding the Discriminant

Quadratic Graphs in the form y = kx²

1. Write down the equation of the graphs shown below, which have the form $y = kx^2$.

(a) (2,4)

(b) (1,3)

(c) (1,5)
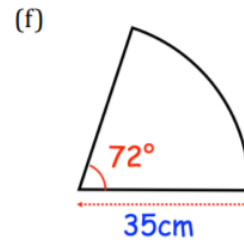
(d) (−2,6)

(e) (2,20)

(f) (−3,27)

(g) (3,−9)

(h) (−2,−8)

(i) (1,−5)

(j) (−2,2)

(k) (2,1)

(l) (3,3)
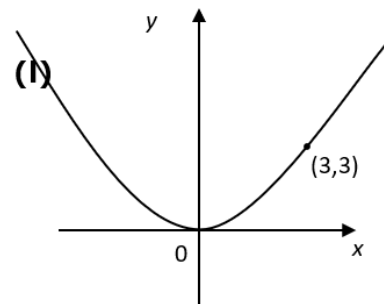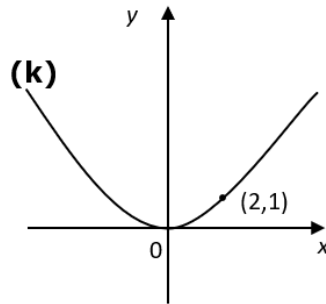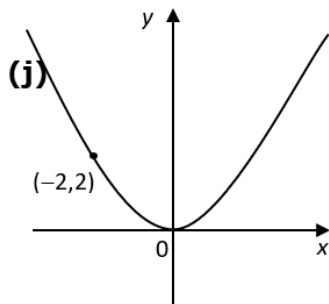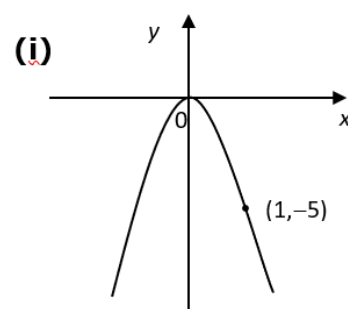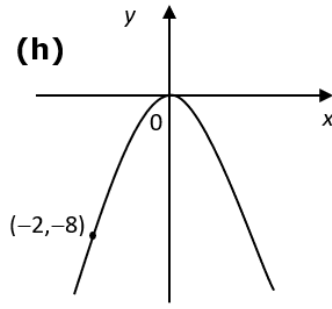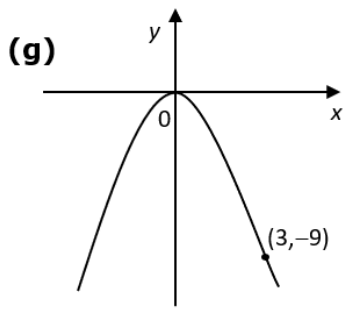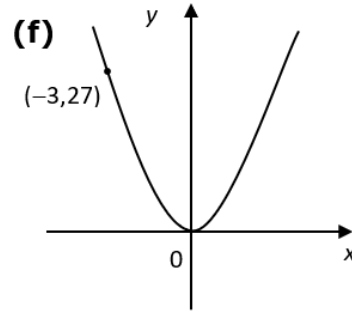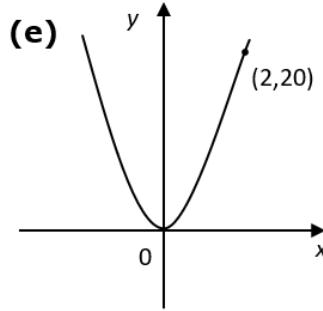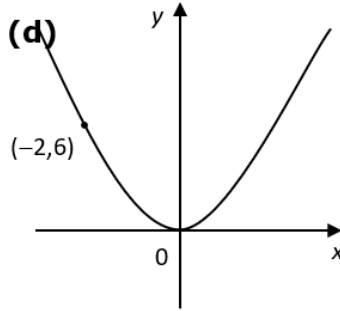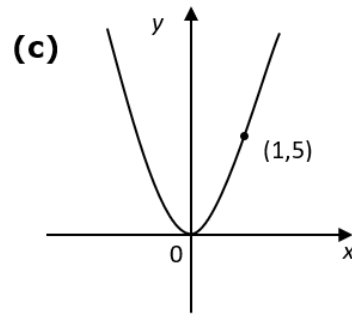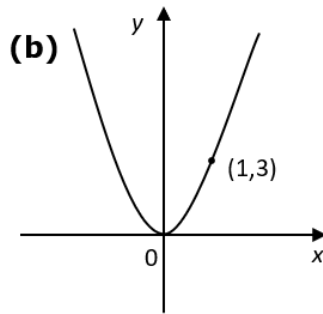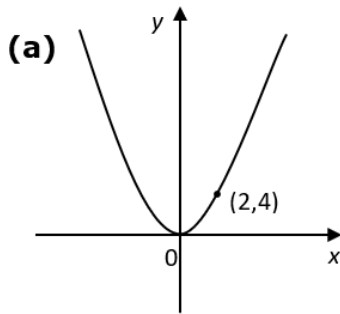
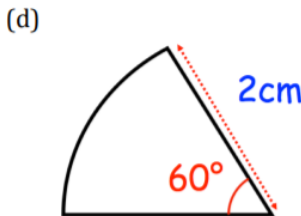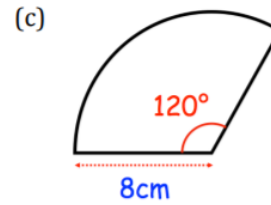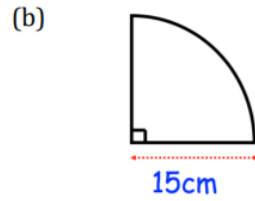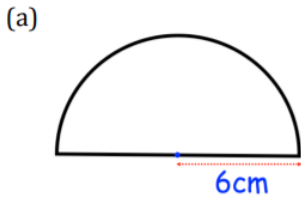# 10. Arc Length and Sector Area

Sector Area

Question 1: Calculate the area of each of the following sectors.
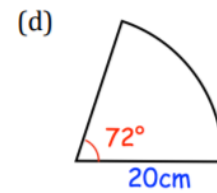   Give each answer to one decimal place and include units.

(a)

6cm

(b)

15cm

(c)

120°

8cm

(d)

2cm

60°

(e)

36°

7m

(f)

72°

35cm

(g)

40°

16cm

(h)

240°

10cm

(i)

144°

3cm
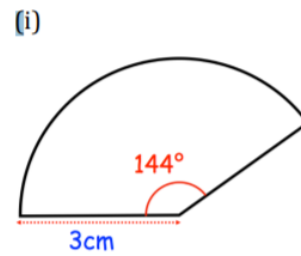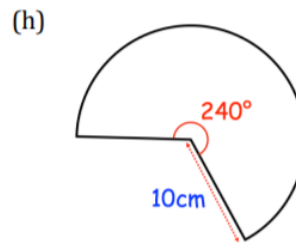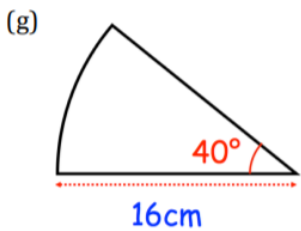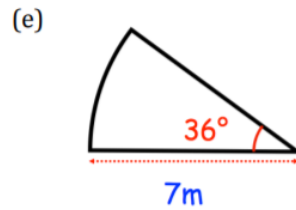
Arc Length

Question 1: For each sector below, calculate the length of the arc.
            Give your answers to one decimal place and include suitable units.

(a)

6cm

(b)

120°

15cm

(c)

30°

4m

(d)

72°

20cm
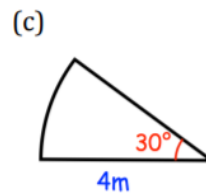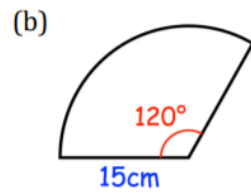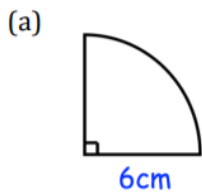
Question 2: For each sector below, calculate the length of the arc.
            Give your answers to one decimal place and include suitable units.

(a)

14°

8cm

(b)

150°

19cm

(c)

73°

25.2cm

(d)

235°

60cm

11. Algebraic Fractions

Simplifying

Question 1:   Simplify the following algebraic fractions

(a) $\dfrac{42xyz}{56}$

(b) $\dfrac{45ab}{60abc}$

(c) $\dfrac{16mn}{18n}$

(d) $\dfrac{40x^2y}{32xy}$

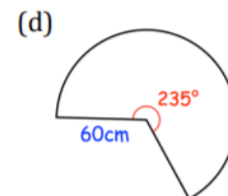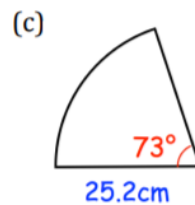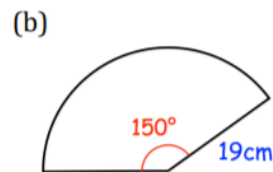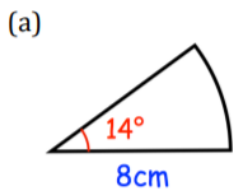(e) $\dfrac{17cf}{34c^3}$

(f) $\dfrac{8x^4}{2x^2}$

(g) $\dfrac{33a^2b^2}{44a^3b}$

(h) $\dfrac{12x^3}{20x^7}$

Question 2:   Simplify the following algebraic fractions

(a) $\dfrac{6x + 8}{2}$

(b) $\dfrac{9x - 12}{3}$

(c) $\dfrac{35x^2 + 20}{5}$

(d) $\dfrac{7m - 70n^3}{7}$

(e) $\dfrac{10c + 25}{15}$

(f) $\dfrac{8w + 2 - 4x}{12}$

(g) $\dfrac{9x^2 + 12x + 33}{6}$

(h) $\dfrac{3x^2 + 5x}{x}$

(i) $\dfrac{3x^3 - 7x^2}{x}$

Question 3:   Simplify the following algebraic fractions

(a) $\dfrac{(x + 6)(x + 3)}{(x + 3)}$

(b) $\dfrac{(x - 1)(x + 1)}{(x - 1)}$

(c) $\dfrac{(x - 3)}{(x - 4)(x - 3)}$

(d) $\dfrac{(x + 7)^2}{(x + 7)}$

(e) $\dfrac{(x - 3)(x + 2)}{(x + 2)(x + 9)}$

(f) $\dfrac{(x + 2)(x + 4)^2}{(x + 4)}$

Question 4:   Simplify the following algebraic fractions

(a) $\dfrac{x^2 + 5x + 4}{x^2 + 4x + 3}$

(b) $\dfrac{x^2 + 6x + 9}{x^2 - 2x - 15}$

(c) $\dfrac{x^2 - 2x}{x^2 + 2x - 8}$

(d) $\dfrac{x^2 - 7x + 10}{x^2 + 3x - 10}$

(e) $\dfrac{x^2 + 8x + 15}{x^2 - x - 12}$

(f) $\dfrac{x^2 + 13x + 40}{x^2 + 14x + 48}$

(g) $\dfrac{x^2 - 2x - 8}{x^2 + 6x - 40}$

(h) $\dfrac{x^2 + 10x + 24}{x^2 - 36}$

(i) $\dfrac{x^2 + 4x - 45}{x^2 + 10x + 9}$

(j) $\dfrac{x^2 + 11x}{x^2 - 121}$

(k) $\dfrac{x^2 - 1}{x^2 + x}$

(l) $\dfrac{x^2 - 15x + 44}{x^2 - 16}$

Adding and Subtracting

1. Express the following as a simplified single fraction

(a) $\dfrac{x}{3} + \dfrac{x}{5}$

(b) $\dfrac{c}{2} + \dfrac{c}{7}$

(c) $\dfrac{w}{3} + \dfrac{w}{9}$

(d) $\dfrac{x}{2} - \dfrac{x}{3}$

(e) $\dfrac{a}{5} - \dfrac{a}{9}$

(f) $\dfrac{m}{2} - \dfrac{m}{8}$

2. Express the following as a simplified single fraction

(a) $\dfrac{x+4}{3} + \dfrac{x+1}{2}$

(b) $\dfrac{2x+1}{2} + \dfrac{x+3}{5}$

(c) $\dfrac{5x-2}{3} + \dfrac{2x+7}{4}$

(d) $\dfrac{3x+11}{2} + \dfrac{x-20}{3}$

(e) $\dfrac{5x-4}{2} + \dfrac{x+1}{3}$

(f) $\dfrac{x-4}{8} + \dfrac{2x-3}{2}$

(g) $\dfrac{7x+4}{2} - \dfrac{x+1}{3}$

(h) $\dfrac{9x+1}{5} - \dfrac{x+2}{2}$

(i) $\dfrac{3x+11}{2} - \dfrac{2x-3}{6}$

3. Express the following as a simplified single fraction

(a) $\dfrac{2}{x+5} + \dfrac{3}{x+1}$

(b) $\dfrac{2}{x+1} + \dfrac{1}{x+3}$

(c) $\dfrac{4}{x+5} - \dfrac{2}{x-1}$

(d) $\dfrac{x+1}{x-2} + \dfrac{x+3}{x+5}$

(e) $\dfrac{x+3}{2x+1} - \dfrac{x-2}{x-1}$

(f) $\dfrac{x}{x+7} + \dfrac{2x+5}{3x+1}$

Multiplying

Question 1: Express the following as a single fraction.

(a) $\dfrac{2}{9} \times \dfrac{3}{h}$

(b) $\dfrac{3}{c} \times \dfrac{a}{4}$

(c) $\dfrac{w}{x} \times \dfrac{3}{a}$

(d) $\dfrac{3a}{7} \times \dfrac{2c}{9}$

(e) $\dfrac{a}{e} \times \dfrac{f}{b}$

(f) $\dfrac{e}{8} \times \dfrac{d}{8}$

Question 2: Express the following as a single **simplified** fraction.

(a) $\dfrac{2x}{y} \times \dfrac{y}{4}$ (b) $\dfrac{3a}{c} \times \dfrac{5}{6}$ (c) $\dfrac{4}{5a} \times \dfrac{5w}{8}$

(d) $\dfrac{3a}{7} \times \dfrac{2c}{9}$ (e) $\dfrac{10g}{w} \times \dfrac{w}{5}$ (f) $\dfrac{4x}{5y} \times \dfrac{3y}{8x}$

Division

Question 1: Express the following as a single **simplified** fraction.

(a) $\dfrac{x}{2} \div \dfrac{2}{3}$ (b) $\dfrac{a}{c} \div \dfrac{d}{5}$ (c) $\dfrac{3}{w} \div \dfrac{2}{a}$

(d) $\dfrac{c}{4} \div \dfrac{3}{c}$ (e) $\dfrac{3a}{4} \div \dfrac{6c}{7}$ (f) $\dfrac{4x}{9y} \div \dfrac{6x}{7}$

(g) $\dfrac{10x}{3y} \div \dfrac{15x}{y}$ (h) $\dfrac{ab}{3} \div \dfrac{2a}{b}$ (i) $\dfrac{4fg}{h} \div \dfrac{f}{2h}$

Question 2: Express the following as a single fraction. **Simplify** if possible.

(a) $\dfrac{x-4}{8} \div \dfrac{3x-12}{2}$ (b) $\dfrac{x+3}{x+2} \div \dfrac{x+1}{x+2}$ (c) $\dfrac{x+1}{2} \div \dfrac{2x+2}{3}$

(d) $\dfrac{3x+9}{2} \div \dfrac{x+3}{4}$ (e) $\dfrac{4}{x-2} \div \dfrac{3}{x^2-2x}$ (f) $\dfrac{11}{4x^2+2x} \div \dfrac{3}{2x+1}$

12. Straight Line

Calculating the Gradient

1. Find the gradient of the line passing through each pair of points

(a) (1, 4) and (3, 10)   (b) (0, 0) and (3, 12)   (c) (5, −2) and (9, 14)

(d) (−8, 6) and (0, −2)   (e) (−5, −9) and (1, 3)   (f) (−7, −2) and (1, −4)

Equation of a Straight Line

Question 1: Write down the gradient of each of these lines.

(a) y = 3x + 1   (b) y = 2x − 5   (c) y = 7x + 4   (d) y = 10x + 5

(e) y = x − 2   (f) y = 6x   (g) y = −4x + 3   (h) y = −3x − 7

(i) $y = \dfrac{1}{2}x + 3$ (j) $y = -\dfrac{4}{5}x - 9$

Question 2:   Write down where each of these lines cross the y-axis (y-intercept)

(a) $y = 2x + 3$ (b) $y = 7x + 1$ (c) $y = 3x - 2$ (d) $y = x - 5$

(e) $y = 2x$ (f) $y = -4x + 6$ (g) $y = -5x - 3$ (h) $y = -3x$

(i) $y = \frac{4}{3}x + \frac{2}{5}$ (j) $y = -\frac{2}{3}x - \frac{1}{2}$

Question 3:   Write down the equation of the lines below

(a) gradient of 3 and y–intercept of 6   (b) gradient of 2 and y–intercept of –1

(c) gradient of –4 and y–intercept of 3   (d) gradient of 8 and y–intercept of 4

(e) gradient of 1 and passing though (0, 4)   (f) passing through (0, –2) with gradient 4

(g) gradient of –5 and passing through the origin.

Question 4: Find the equation of each line below

(a)

(b)

(c)
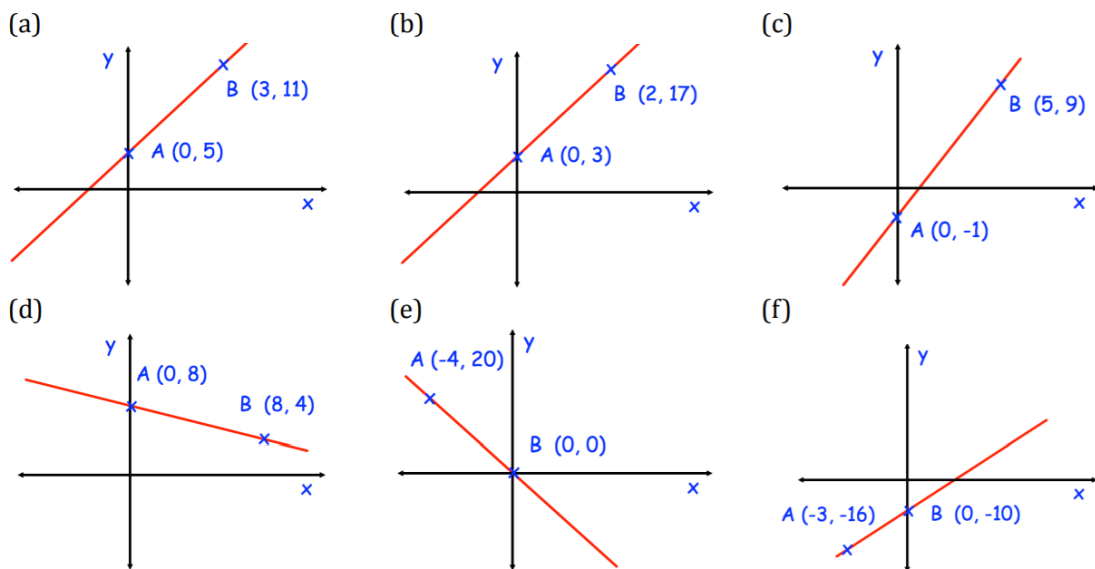
Finding the equation of a straight line

(d)

(e)

(f)

Question 5: Find the equation of the line passing through each pair of points

(a) $(0, 3)$ and $(4, 19)$ (b) $(0, 2)$ and $(6, 20)$ (c) $(0, 0)$ and $(1, 4)$

(d) $(0, -9)$ and $(9, 0)$ (e) $(0, -6)$ and $(7, 8)$ (f) $(-8, -10)$ and $(0, 14)$

(g) $(0, 2)$ and $(10, 7)$ (h) $(-4, 1)$ and $(0, 7)$ (i) $(-4, 0)$ and $(0, 18)$

Rearranging the Equation

1. Rearrange the equation to find the gradient and y-intercept

(a) $x + y = 10$ (b) $x - y = 4$ (c) $2x + y = 6$

(d) $3x - y = -1$ (e) $8x + 2y + 9 = 0$ (f) $5x - 2y - 4 = 0$

(g) $7x = 1 - 2y$ (h) $15y - 6x = 8$ (i) $\frac{2}{3}x + 2y = 5$

(j) $\frac{1}{5}y - \frac{1}{2}x = 1$ (k) $\frac{2}{3}x + \frac{3}{4}y = 1\frac{1}{2}$

13. Solving Equations

Two-Step Equations

1. Solve the following equations

(a) $2x + 3 = 9$

(b) $3w - 1 = 14$

(c) $7y + 2 = 30$

(d) $5x + 20 = 35$

(e) $6c - 12 = 48$

(f) $8m - 4 = 20$

(g) $7w + 13 = 90$

(h) $12p - 18 = 30$

(i) $9w - 5 = 67$

(j) $10a + 40 = 100$

(k) $9x - 24 = 84$

(l) $7w + 1 = 1$

(m) $6x - 19 = 5$

(n) $3w + 4 = 43$

(o) $\dfrac{x}{3} + 1 = 5$

Equations with letters on both sides

Question 1: Solve the following equations

(a) $4x + 1 = 2x + 7$

(b) $5x + 4 = 3x + 16$

(c) $2x + 8 = x + 12$

(d) $7x + 1 = 2x + 46$

(e) $6x - 3 = 2x + 13$

(f) $9x - 10 = 7x + 24$

(g) $2x + 21 = 4x + 5$

(h) $x + 2 = 5x - 2$

(i) $6x - 9 = 4x - 1$

(j) $5x + 2 = 16 - 2x$

(k) $3x - 1 = 23 - x$

(l) $6x + 8 = 38 - 4x$

Question 2: Solve the following equations

(a) $5(x + 3) = 3(x + 9)$

(b) $8(x - 1) = 4(x + 3)$

(c) $3(x + 13) = 10(x - 1)$

(d) $2(4x - 3) = 5(2x - 5)$

(e) $9(2x - 5) = 3(4x + 7)$

(f) $2(9 - x) = 3(x + 16)$

Equations with Fractions

Question 1: Solve the following equations

(a) $\dfrac{x}{2} = 6$

(b) $\dfrac{w}{3} = 1$

(c) $\dfrac{a}{4} = 10$

(d) $\dfrac{w}{8} = 7$

(e) $\dfrac{x}{10} = 23$

(f) $\dfrac{c}{9} = 5$

(g) $\dfrac{t}{14} = 15$

(h) $\dfrac{y}{3} = 1.5$

(i) $\dfrac{x}{4} = 1.6$

(j) $\dfrac{x}{2.5} = 8$

(k) $\dfrac{x}{4} = -3$

(l) $\dfrac{x}{6} = -12$

Question 2:   Solve the following equations

(a) $\dfrac{x}{4} + 1 = 9$ (b) $\dfrac{x}{2} - 5 = 9$ (c) $\dfrac{w}{5} + 2 = 3$ (d) $\dfrac{x}{8} - 7 = 2$

(e) $\dfrac{m}{3} - 4 = 0$ (f) $\dfrac{x}{6} + 7 = 2$ (g) $\dfrac{k}{4} + 5 = -6$ (h) $\dfrac{x}{6} - 2 = -8$

Question 3:   Solve the following equations

(a) $\dfrac{x+1}{2} = 3$ (b) $\dfrac{w-4}{3} = 2$ (c) $\dfrac{x-2}{7} = 6$ (d) $\dfrac{w+9}{4} = 8$

(e) $\dfrac{w-25}{3} = -7$ (f) $\dfrac{x+2}{4} = -1$ (g) $\dfrac{w+20}{8} = -2$ (h) $\dfrac{x-9}{4} = -2$

Question 4: Solve the following equations

(a) $\dfrac{3x+5}{2} = 7$ (b) $\dfrac{5x-12}{3} = 11$ (c) $\dfrac{4x+2}{6} = 5$ (d) $\dfrac{10x+3}{4} = 4$

(e) $\dfrac{5x-8}{2} = 10$ (f) $\dfrac{8x+4}{5} = 12.8$ (g) $\dfrac{2x+13}{3} = 1$ (h) $\dfrac{3x-4}{7} = -4$

(i) $\dfrac{7x-12}{3} = -25$ (j) $\dfrac{29-2x}{3} = 5$ (k) $\dfrac{100-5x}{3} = 30$ (l) $\dfrac{24-3x}{12} = 5$

Question 5: Solve the following equations

(a) $\dfrac{x+3}{2} + \dfrac{x+1}{4} = 10$ (b) $\dfrac{x+3}{10} + \dfrac{x-2}{5} = 2$ (c) $\dfrac{2x-1}{9} + \dfrac{x+2}{3} = 0$

(d) $\dfrac{x-1}{4} - \dfrac{x+3}{2} = -4$ (e) $\dfrac{4x+9}{15} - \dfrac{x-3}{5} = 1$ (f) $\dfrac{x+4}{3} + \dfrac{x+1}{2} = 1$

(g) $\dfrac{3x+5}{4} - \dfrac{x-7}{5} = 1$ (h) $\dfrac{2x-5}{7} - \dfrac{2x-1}{2} = 3$ (i) $\dfrac{x}{2} + \dfrac{4x+1}{10} = -8$

Solving Inequalities

1. Solve the following

(a) $4x + 3 > 2x + 11$ (b) $x + 1 \geq 3x - 18$

(c) $13x - 12 < 3x + 13$ (d) $7x - 5 \geq 3x + 11$

Solving inequalities

14. Changing the Subject of a Formula

Question 1: Make y the subject of each of the following

(a) $y + w = c$

(b) $y - p = m$

(c) $m + y = s$

(d) $y - 2g = n$

(e) $3y = c$

(f) $ay = w$

(g) $\dfrac{y}{c} = w$

(h) $\dfrac{y}{a} = 2c$

(i) $a = y + p$

(j) $c = y - k$

(k) $y^2 = s$

(l) $y^3 = x$

(m) $\sqrt{y} = g$

(n) $\pi y = c$

(o) $n - y = t$

(p) $ry = c$

(q) $4\pi y = b$

(r) $y + 7t = c + r$

(s) $\dfrac{r}{y} = w$

(t) $y^2 = k + x$

(u) $A = xy$

Question 2: Make x the subject of the following formulae

(a) $4x + c = w$

(b) $dx - t = 8$

(c) $x^2 + 3 = h$

(d) $2x + 2y = P$

(e) $s = x^2 - 3$

(f) $y = xz + s$

(g) $\dfrac{x}{n} + 2 = w$

(h) $\dfrac{x}{6} - 5 = w$

(i) $\dfrac{x + 3}{c} = h$

(j) $3y = 4x + 1$

(k) $x^2 + a = v$

(l) $x^3 - 4 = 5y$

(m) $\dfrac{x + t}{m} = 2c$

(n) $\dfrac{w + x}{u} = 3z$

(o) $A = \pi x^2$

(p) $A = \tfrac{1}{2}bx$

(q) $V = abx$

(r) $v^2 = u^2 + 2ax$

(s) $\dfrac{a + b}{x} = r$

(t) $\dfrac{5cx}{b} = a$

(u) $\sqrt[3]{\dfrac{x}{k}} = w$

Question 3: Make c the subject of the following

(a) $(a + c)^2 = t$

(b) $v = u + ac$

(c) $v = \pi c^2 h$

15. Solving Simultaneous Equations

Solving Simultaneous Equations by Elimination

Solving Simultaneous Equations

Question 1:   Solve the following simultaneous equations by using elimination.

(a) $6x + y = 18$
      $4x + y = 14$

(b) $4x + 2y = 10$
      $x + 2y = 7$

(c) $9x - 4y = 19$
      $4x + 4y = 20$

(d) $2x + y = 36$
      $x - y = 9$

(e) $6x - 3y = 12$
      $4x - 3y = 2$

(f) $3x - 6y = 6$
      $2x - 6y = 3$

(g) $8x + 7y = 39$
      $8x + 2y = 34$

(h) $x + 3y = 38$
      $x + 6y = 53$

(i) $6x + 3y = 48$
      $6x + y = 26$

Question 2:   Solve the following simultaneous equations by using elimination.

(a) $3x + 2y = 23$
      $2x - y = 6$

(b) $3x - 3y = 9$
      $2x + y = 12$

(c) $4x + 2y = 34$
      $3x + y = 21$

(d) $9x - 4y = 59$
      $2x - y = 12$

(e) $2x + 8y = 43$
      $x + 3y = 18$

(f) $6x + 3y = 45$
      $2x - 2y = 12$

(g) $5x + 4y = 130$
      $x + 6y = 130$

(h) $10x - 15y = 25$
      $x - 2y = 1$

(i) $3x + 8y = 97$
      $2x + 4y = 58$

Question 3:   Solve the following simultaneous equations by using elimination.

(a) $2x + 2y = 14$
      $5x - 3y = 19$

(b) $2x + 3y = 1$
      $7x + 2y = -22$

(c) $5x + 3y = 22$
      $2x + 4y = 20$

(d) $5x - 6y = 28$
      $4x - 4y = 24$

(e) $3x + 2y = 7$
      $2x + 9y = 43$

(f) $3x + 3y = -6$
      $4x - 4y = -24$

(g) $3x + 8y = 31$
      $5x + 3y = 31$

(h) $7x - 15y = 2.5$
      $3x - 2y = 5.5$

(i) $3x + 2y = 53$
      $2x + 5y = 72$

Worded Simultaneous Equations

Question 1:   The cost of buying a coffee and a tea in a cafe is £4.
              The cost of buying a coffee and three teas in a cafe is £7.
              Work out the cost of buying a coffee and the cost of buying a tea.

Question 2:   The sum of Rosemary's age and Hannah's age is 102 years.
              The difference between Rosemary's age and Hannah's age is 52 years.
              Rosemary is older than Hannah.
              Find the age of each woman by using simultaneous equations.

Question 3:   Five adult tickets and three child tickets for a movie cost £58.
              Two adult tickets and eight child tickets for a movie cost £47.
              Find the cost of each type of ticket.

Question 4:   Four chairs and two tables cost £218.
              Six chairs and seven tables cost £587.
              Find the total cost of buying twenty chairs and five tables.

Question 5:   A plumber charges a price for each hour, £h, and a fixed charge, £c.
              A 5 hour job costs £155 in total.
              A 8 hour job costs £230 in total.
              How much would a job that lasts 2 hours cost?

Question 6:   Barry buys 200 pieces of stationery for £76.
              Of the 200 pieces of stationery, x of them are rulers that cost 50p each and y of
              them are pens that cost 20p each.
              Find how many rulers Barry buys and how many pens he buys.

Question 7:   In a greengrocers, 4kg of bananas and 3kg of apples costs £7.50
              In the same greengrocers, 3kg of bananas and 5kg of apples costs £8.10
              How much would 2kg of bananas and 2kg of apples cost?