

WELSH JOINT EDUCATION COMMITTEE

General Certificate of Education
Primary Level
Examination Papers

ARITHMETIC & ALGEBRA

197-198

PUBLISHED UNDER SPECIAL ARRANGEMENT
WITH THE WELSH JOINT EDUCATION COMMITTEE

THE EDUCATIONAL SUPPLY ASSOCIATION LTD
PINNACLES, BARKING, ESSEX

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WELSH JOINT EDUCATION COMMITTEE

General Certificate of Education
Ordinary Level
Examination Papers

IN

ARITHMETIC & ALGEBRA

1957—1962

144 | 2.1584
68 | 1.5736

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PUBLISHED UNDER SPECIAL ARRANGEMENT
WITH THE WELSH JOINT EDUCATION COMMITTEE

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THE EDUCATIONAL SUPPLY ASSOCIATION LTD
PINNACLES, HARLOW, ESSEX.

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WELSH JOINT EDUCATION COMMITTEE
GENERAL CERTIFICATE OF EDUCATION

SUMMER EXAMINATION, 1957

ORDINARY LEVEL

ARITHMETIC

(2½ Hours)

[Answer ALL questions from Section A and FOUR from Section B.
Logarithms must NOT be used in Questions 1 and 2.]

SECTION A

1. (i) Simplify $5\frac{1}{4} \times 2\frac{2}{3}$, $5\frac{1}{4} \div 2\frac{2}{3}$, and $5\frac{1}{4} - 2\frac{2}{3}$.

(ii) Make out a bill for the following purchases: 4 eggs at 5s. 6d. a dozen; 15 lb. plums at 5 lb. for 1s. 6d.; and 6 oz. bacon at 4s. 8d. per lb.

(iii) Find the average weight of six loads, three weighing 15 cwt. 78 lb. each, two weighing 11 cwt. 9 lb. each, and one weighing 12 cwt. 38 lb.

2. (i) On a map drawn to the scale of 1:12,672, two points are 1.6 in. apart. Calculate, correct to the nearest yard, the distance between the corresponding places on the ground.

(ii) A cycle costing £15. 2s. 6d. is sold for £17. 12s. 11d. Express the profit as a percentage of the cost price.

(iii) The total rateable value of all the properties in a town is $1\frac{3}{4}$ million pounds. What rate in the pound, correct to the nearest penny, must be levied to collect $1\frac{1}{4}$ million pounds?

3. The distance by rail from Newport to Paddington is 133.6 miles. A train is scheduled to leave Newport at 5.19 p.m. on its non-stop run to Paddington at an average speed of 54.9 m.p.h. One day the train arrives on time, having taken 4 min. 28 sec. to traverse the Severn Tunnel, which is 4.33 miles long.

(i) Find, correct to the nearest $\frac{1}{10}$ m.p.h., the amount by which the average speed in the tunnel exceeds the average speed for the whole journey.

(ii) Calculate, correct to the nearest minute, the time at which the train is due at Paddington.

(iii) The second-class fare from Newport to Paddington is £1 1s. 1d. Express this fare in pence per mile, correct to three significant figures.

SECTION B

[Answer any FOUR questions from this section.]

4. (i) A telescope is mounted in a building whose walls, forming the curved surface of a circular cylinder of height 16 ft., are surmounted by a domed roof in the shape of a hemisphere of the same radius as the cylinder. If the area of the floor is 616 sq. ft., find the volume of the building.

[A hemisphere of radius r has a volume of $\frac{2}{3}\pi r^3$. Take $\pi = 3\frac{1}{7}$ and neglect the thickness of the walls.]

(ii) An empty rectangular tank, open at the top, weighs 34 lb. 1 oz. Its base is 1 ft. 6 in. long and 1 ft. 4 in. wide, and its height is 1 ft. 3 in. Neglecting the metal used in overlapping, find the weight of 1 sq. ft. of the sheet metal of which the tank is made.

5. (i) A man borrows 2 million francs. A year later he pays 200,000 francs, of which part is the year's interest at $4\frac{1}{2}$ per cent. and the remainder is to reduce the debt. After a further year he pays another 200,000 francs, of which part is the $4\frac{1}{2}$ per cent. interest on the reduced debt and the remainder is to reduce the debt still further. How much does he owe after the second payment?

(ii) A man spends £2,310 in buying $4\frac{3}{8}$ per cent. stock. If his annual income from the stock is £105, how much did he pay for each £100 of stock?

6. (i) 1 c.c. of aluminium weighs 2.65 gm. Find, in ounces, correct to three significant figures, the weight of 1 cu. in. [1 in. = 2.54 cm., 1 lb. = 453.6 gm.]

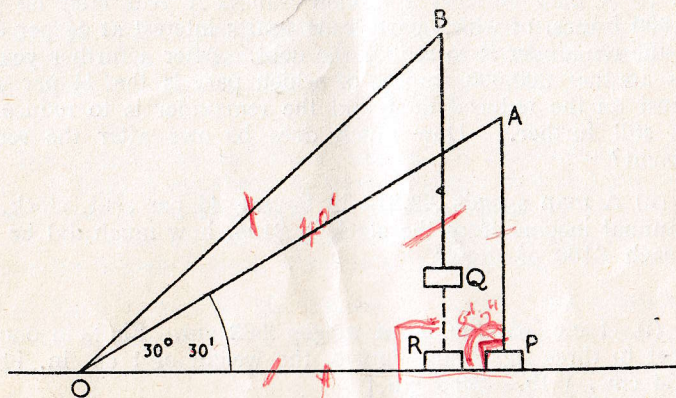
(ii) A clock, set to the correct time at noon on Monday, shows the time as 11.57 at noon on Tuesday. What is the correct time, to the nearest second, when the clock shows 3.30 on Wednesday afternoon?

7. Draw a graph to show the income-tax paid on taxable incomes up to £250 in a year when the regulations were as follows: the first £100 of taxable income is taxed at the rate of 2s. 6d. in the £ and the remainder at 5s. in the £. Use 1 in. to represent £50 of taxable income and £5 of tax.

(i) Use the graph to find the taxable income of a man who pays £40 tax.

(ii) A man with a total income of £720, all earned, finds his taxable income by deducting the total of the following from his total income: two-ninths of earned income; £210 personal allowance; £170 children's allowance. Use the graph to find the income-tax he pays.

8. A load hangs from a crane whose jib, OA , is 40 ft. long. When the elevation of the jib is $30^\circ 30'$ the load just touches the ground at P . The jib is then raised to the position OB , when the load is at Q , where $BQ = AP$. Calculate, correct to the nearest inch, the length of chain which must be let out until the load touches the ground at R , which is 8 ft. 3 in. nearer to O than P is.



9. Two observers A and B , 1,250 yds. apart, observe a tower whose foot T is at the same level as themselves, and find $\angle TAB = 64^\circ 15'$ and $\angle TBA = 50^\circ 45'$. Calculate the length of TB in yards, and the area of $\triangle ATB$ in acres. [1 acre = 4,840 sq. yds.]

If B is north-east of A and T is further north than A , what is the bearing of T from each observer?

GENERAL CERTIFICATE OF EDUCATION
SUMMER EXAMINATION, 1957

ORDINARY LEVEL

ALGEBRA

(2½ Hours)

[Answer ALL questions from Section A and FOUR from Section B.]

SECTION A

- (i) Given that $s = ut + \frac{1}{2}ft^2$, calculate the value of s when $u = 80$, $t = 2.5$, and $f = -32$.
(ii) Divide $1 - 3x + 9x^2 - 14x^3$ by $1 - 2x$.

(iii) Copy and complete the statement
 $x^2 + 7x + \dots = (x + \dots)^2$.

(iv) Factorize:

- $xy - 2ay + 3bx - 6ab$,
- $x^2 + 3bx - 4b^2$.

2. Solve the equations

(i) $\frac{2}{3}(x - 5) - \frac{1}{2}(x - 3) = 1$,

(ii) $\left. \begin{aligned} 2x + 4y + 1 &= 0 \\ 5x - 3y - 4 &= 0 \end{aligned} \right\}$,

(iii) $3x^2 + 4x = 2$, giving the roots correct to two decimal places.

3. (i) If y varies inversely as x , and, when $x = 30$, $y = 20$, find the value of y when $x = 25$.

(ii) A ladder 30 ft. long rests against a vertical wall, with the foot of the ladder on the horizontal ground 10 ft. away from the foot of the wall. What angle does the ladder make with the ground?

From the foot of the ladder the angle of elevation of a window sill in the wall is $56^\circ 20'$. Find the height of the window sill above the ground, and find also the height of the top of the ladder above the window sill.

SECTION B

[Answer any FOUR questions from this section.]

4. (i) 600 tickets were sold for a concert, some at 2s. 6d. each and the others at 4s. The total sum raised was £93. 12s. How many tickets were sold at 4s.?

(ii) Find the values of p and q if
 $2p + 3q = 1$ and $p^2 - 2q^2 = 7$.

5. (i) Express each of the numbers 64, 2, 1, and $\frac{1}{2}$ as a power of 8.

(ii) Find x in terms of a and b when

$$\frac{x-3b}{2a} = \frac{x-2a}{3b}.$$

(iii) Find the value of a if the remainders when $x^3 + 2x^2 - ax - 10$ is divided by $x - 2$ and by $x + 1$ are the same. Find also what this remainder is.

6. In the quadrilateral $ABCD$ the angles A and B are right angles and $AB=20$ in., $BC=17$ in., $AD=7$ in. P is a point in AB , and PQ , drawn at right angles to AB , cuts DC at Q . If $AP=x$ in. and $PQ=y$ in., show that $y=7+\frac{1}{2}x$.

Find and solve an equation for x if PQ bisects the area $ABCD$.

7. Calculate the value of $x^3 - 4x + 1$ for values of x at intervals of one-half from $x = -2\frac{1}{2}$ to $x = 2\frac{1}{2}$, and hence draw the graph of $x^3 - 4x + 1$ for this range of values of x . Take an inch to represent one unit on the x -axis and two units on the y -axis. Use your graph to answer these questions, marking it to show how your answers are obtained.

(i) Has $x^3 - 4x + 1$ a minimum value in the range? If so, what is it and what is the corresponding value of x ?

(ii) What is the approximate value of the negative root of the equation $x^3 = 4x - 1$?

8. (i) How many terms are there in the arithmetic progression 10, 13, 16, ..., 1,000, and what is their sum?

(ii) The first two terms of a geometric progression are $2\frac{1}{2}$, $3\frac{1}{3}$. Find the third term. Write down an expression for the sum of the first ten terms of this progression, and evaluate the expression, using logarithms.

9. (i) Referred to perpendicular axes Ox and Oy , A and B are the points (0,2) and (6, 5) respectively. Sketch the figure and calculate (1) the gradient of AB , (2) the equation of the line AB .

(ii) In the triangle ABC , $AB=3$ ft., $AC=5$ ft., and $BC=7$ ft. Show that $\cos A = -0.5$ and deduce the magnitude of $\angle A$. Find also the area of the triangle.

GENERAL CERTIFICATE OF EDUCATION

SUMMER EXAMINATION, 1958

ORDINARY LEVEL

(2½ Hours)

ARITHMETIC

[Answer ALL questions from Section A and FOUR from Section B. The working by which you arrive at your results should appear on the right-hand page of your answer book. Logarithms must NOT be used in Section A.]

SECTION A.

1. (i) Find the cost of 3 tons 6 cwt. of coal at £8 7s. 6d. per ton.

(ii) A drum holds 8 kg. 16 gm. of powder. How many bottles, each holding 48 gm., can be filled from the drum?

(iii) Express $(4\frac{1}{4} - 1\frac{1}{3}) \times (1\frac{1}{7} + \frac{2}{5})$ as a single fraction in its lowest terms.

(iv) Find the prime factors of 5,544. Hence, or otherwise, find the value of $\sqrt{(5,544/\pi)}$, taking π to be $\frac{22}{7}$.

2. (i) A container is three-fifths full of wheat. When 8 bushels are added, the container is five-sevenths full. How many more bushels must be added to fill the container?

(ii) A rectangular block, 5.6 cm. wide and 4.8 cm. deep, has a volume of 198 c.c. Calculate its length, correct to three significant figures.

(iii) On Wednesday, 7th August, 1957, the Caledonian Express covered the 401 mile run from Glasgow to London in the record time of 6 hr. 27 min. Calculate its average speed in miles per hour, correct to three significant figures.

3. A merchant bought 1 cwt. of bananas for 5 guineas. He sold 54 lb. at 1s. 6d. per lb., threw away some which were bad, and sold the remainder at 1s. 3d. per lb. If he received a total of £6. 16s. for the bananas, calculate:

- (i) the profit per cent. on the transaction, correct to the nearest whole number;
- (ii) the number of bananas bought, if their average weight was $3\frac{1}{2}$ oz.;
- (iii) the weight of bananas thrown away.

SECTION B

[Answer any FOUR questions from this section.]

4. A square sheet of thin metal, of side 1 m., provides material for twelve cylindrical containers, each of radius 5.4 cm. and height 13.6 cm. Each cylinder, which is to be closed at both ends, requires an extra 18 sq. cm. of metal for developing. What area of the sheet is left?

How many of these containers can be completely filled from a can containing 3 gallons of liquid?

[Take $\log \pi$ to be 0.4972 and 1 pint to equal 568 c.c.]

5. Between 1930 and 1940 the population of a town increased by 6 per cent. Between 1940 and 1950 the population decreased by $2\frac{1}{2}$ per cent. of its value in 1940, and between 1950 and 1960 it is expected to increase by $6\frac{3}{4}$ per cent. of its value in 1950. If the population was 127,200 in 1940, what is it expected to be in 1960?

Calculate the population in 1930, and express the total expected in the thirty years as a percentage of this.

6. (i) A man has bought his house, borrowing the money from a Building Society. At the beginning of one year he owes the Society £2,244, on which he pays 5 per cent. interest. During the year he also pays £55 to reduce the debt, £23. 18s. for repairs, and rates at 16s. 3d. in the pound, the rateable value of his house being £52. How much per week is the total of these payments?

(ii) A paste is made by mixing powder with water, their volumes being in the ratio 5:2. The volume of paste is only nine-tenths of the volume of the constituents, but the weight remains unaltered. If 1 cu. ft. of powder weighs $69\frac{1}{2}$ lb. and 1 cu. ft. of water weighs $62\frac{1}{2}$ lb., calculate the weight of 1 cu. ft. of paste.

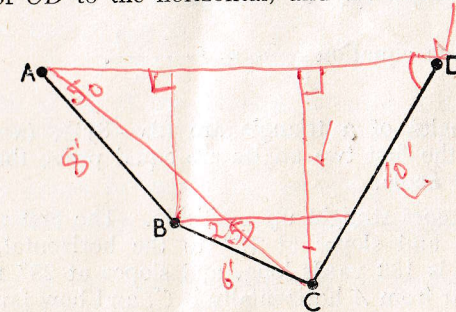
7. The connexion between the frequency and the wavelength of wireless signals is given by the formula: frequency in kilocycles per sec. = $\frac{300,000}{\text{wavelength in metres}}$. Draw a graph to convert wavelength to frequency for signals in the medium wave band, from 200 to 600 m. Take 1 in. to represent 100 m. and 200 kilocycles per sec. Use your graph to find the frequency of the Scottish Regional transmission (371 m.), and also to answer the following question.

On a wireless set on which the pointer moves 1.2 in. for every 100 m. change in wavelength, how far must the pointer be moved to change from one West Regional transmission to the other? Their frequencies are 1,052 and 1,457 kilocycles per sec.

8. (i) Q is 500 yds. from P on a bearing S. 50° W., and R is 200 yds. from P on a bearing N. 40° W. Calculate the distance and bearing of R from Q .

(ii) A vertical flagstaff stands on level ground, and a man observes it through a theodolite placed 5 ft. 6 in. above the ground some distance away. The angle of elevation of the top is 25° , and the angle of depression of the bottom is 3° . Calculate the height of the flagstaff.

9. AB , BC , and CD are three rods fastened together at B and C , and fastened at A and D to two points at the same horizontal level. AB is 8 ft. long and is inclined at 50° to the horizontal; BC is 6 ft. long and is inclined at 25° to the horizontal; CD is 10 ft. long. Calculate the depth of C below AD , the inclination of CD to the horizontal, and the distance AD .



GENERAL CERTIFICATE OF EDUCATION
SUMMER EXAMINATION, 1958

ORDINARY LEVEL

(2½ Hours)

ALGEBRA

[Answer ALL questions from Section A and FOUR from Section B.]

SECTION A

1. (i) Find the value of $3pq^3$ when $p=5$ and $q=-2$.
(ii) Express as single fractions:

$$(1) \frac{x+1}{3} + 2 - \frac{5-x}{6};$$

$$(2) \frac{2}{y} + \frac{3y-2x}{xy}.$$

- (iii) Solve the equation

$$\frac{3p-2}{2p+5} = \frac{1}{2}.$$

2. (i) Factorize $2x^2 - 7x - 15$.
(ii) Divide $6x^3 - x^2 - 14x + 3$ by $2x - 3$.
(iii) Given that $\frac{3x-y}{2x+y} = \frac{4}{5}$, find the value of $\frac{x}{y}$.
(iv) Solve the equation $\frac{1}{2x-1} = 1 - \frac{x+1}{2}$.

3. (i) The angles of a triangle are $(2x-3y)^\circ$, $(x+3y)^\circ$, and $(2x+6y)^\circ$. If the first two angles are equal prove that the third angle is a right angle.

(ii) A path goes straight up a hillside. The first part, AB , is 350 yards long and slopes at 12° to the horizontal, while the remainder, BC , is 150 yards long, and slopes at 28° to the horizontal. How far from A horizontally is C , and how far is it above A ?

SECTION B

[Answer any FOUR questions from this section.]

4. P is a point on a circle of centre O and radius b . T is a point on the tangent to the circle at P and PT is of length t . OT is cut by the circle at X , and XT is of length x .

Prove that $x = \sqrt{(b^2 + t^2)} - b$.

By rearranging this formula deduce the value of t in terms of b and x and calculate t when $b=40$, $x=18$.

5. (i) a and b are numbers such that when

$$x^3 - 3x^2 + ax + b$$

is divided by $x-1$ the remainder is 1, and when it is divided by $x-2$ the remainder is 2. Find a and b .

(ii) Find the value of $\frac{ac}{b^2}$ when $a=2.4 \times 10^3$, $b=4 \times 10^{-2}$, $c=3 \times 10^5$, giving the answer in the form $n \times 10^p$ where n is between 1 and 10 and p is a whole number.

- (iii) Use logarithms to evaluate x given that $x^4=0.6857$.

6. (i) In an experiment, values of x and y were found to correspond as in this table

$x=2.0$	3.0	5.0	8.0
$y=4.75$	3.2	1.9	1.2

On squared paper plot values of y against values of $1/x$. What law connecting x and y is suggested by the result?

- (ii) Solve the equations

$$x - 2y = -1; \quad x^2 + 2y^2 - 5y = 7.$$

7. Draw the graph of the function $2x^2 + 5x - 2$ for values of x from -4 to 1 taking 1 in. as the unit on the axis of x and as 2 units on the axis of y .

Use your graph to answer the questions

- (i) For what range of values of x is the value of the function negative?
(ii) What is the minimum value of the function, and what is the corresponding value of x ?
(iii) For what values of x is $2x^2 + 5x$ equal to 3?

8. (i) The first of a series of numbers in arithmetic progression is 2, the last is 8, and the sum of the numbers is 50. How many numbers are there in the series?

(ii) The first term of a geometric progression is 8, and the fourth term is 27. What is the fifth term?

(iii) The lengths of the sides of a triangle form a geometric progression. The shortest side is 3 in. and the perimeter is 12 inches. Find the length of the longest side, correct to 1 place of decimals.

9. A parallelogram has sides 6 in. and 8 in. long and the longer diagonal is 11 in. Calculate

- (i) the angles of the parallelogram;
- (ii) the length of the other diagonal;
- (iii) the area of the parallelogram.

SUMMER EXAMINATION 1959

ORDINARY LEVEL

ARITHMETIC

(2½ Hours)

Answer ALL questions from Section A and FOUR from Section B. The working by which you arrive at your results should appear on the right-hand page of your answer book.

Logarithms must NOT be used in Section A.

SECTION A

1. (i) A joint of beef cost 15s. 4½d. when the price was 6s. per lb. What was its weight in lb. and oz.?

(ii) Six dozen tins of tomato juice, each weighing 7½ oz., are packed into a crate weighing 3 lb. 5 oz. Find the total weight of the package.

(iii) Simplify $(3\frac{3}{4} - 1\frac{2}{3}) \div 2\frac{1}{2}$.

(iv) Find without using tables the exact square roots of $1\frac{9}{16}$ and 8.5849.

2. (i) A rectangular metal plate of uniform thickness weighs 252 gm. Find its thickness in millimetres if its length and breadth are 12.5 cm. and 7.5 cm. respectively, and 1 c.c. of the metal weighs 8.4 gm.

(ii) A map is drawn on a scale of 5 in. to the mile. Find the Representative Fraction of the map, i.e., the ratio of a length on the map to the actual length represented by it, expressed as a fraction in its lowest terms.

(iii) Copper could be bought for £213. 10s. per ton on Oct. 1st, 1958. On Oct. 16th the price per ton was £241. 5s. Find, correct to two significant figures, the percentage increase in the cost in this time.

3. An electricity board charges householders for electricity supplies according to the number of rooms in the house. Each quarter, 14 units per room in the house are charged at 5¼d. per unit, and for units in excess of this number the charge is 1d. per unit.

(i) Find the total cost of the electricity for a quarter in which 1,620 units are used in a six-roomed house.

(ii) In an eight-roomed house the cost of the electricity in one quarter was £9. 3s. 10d. How many units were used?

SECTION B

Answer any FOUR questions from this section.

4. A block of 110 flats is to be built at a cost of £207,000. The yearly cost of maintenance is estimated to be £6,000, and the rates will amount to £2,700. What average yearly rent must be charged for one of these flats if 6 per cent. profit on the building cost is to be made after the maintenance cost and rates have been met?

If 20 of the flats can be let at £234 per annum, and 45 more at £208 per annum, and the rest are let at equal rents, what should this rent be to fulfil the same conditions as before?

5. (i) The rain water falling on a flat roof of area 320 sq. ft. runs into a covered water-butt in the form of a circular cylinder of diameter 3 ft. placed with its axis vertical. By what amount, in inches, correct to three significant figures, would the depth of water in the butt be increased by a rainfall of 0.36 in.? [Take $\pi = 3.142$ or $\log \pi = 0.4971$.]

(ii) A fire extinguisher is in the shape of a right circular cone of base radius 12 in. and perpendicular height 35 in. Find the total external surface area including the base, giving your answer in square inches as a multiple of π .

[The area of the curved surface of a cone = $\pi \times$ base radius \times slant height.]

6. (i) A shopkeeper marks goods for sale at a price 50 per cent. higher than he pays for them. In a sale he allows a discount of 10 per cent. from the marked price. What percentage profit does he make on articles then sold?

(ii) A man buys 240 5s. shares at 9s. 6d. each. If a dividend of $12\frac{1}{2}$ per cent. on the shares is declared, calculate how much the man receives, and express the dividend as a percentage, correct to two significant figures, of the amount paid for the shares.

7. Draw a graph to show the simple interest on £100 at 5 per cent. per annum for periods up to 73 days (one-fifth of a year). Take 1 inch to represent 10 days, and 1 inch to represent half-a-crown.

Using the graph, write down (i) the interest for 28 days, (ii) the least number of days for which the interest would yield 16s. 6d.

Calculate the number of days for which the interest on £100 at 5 per cent. per annum would be equal to the interest on £200 for 19 days at the same rate. Find, from the graph, what this interest is.

Use the graph also to find the interest on £50 at 7 per cent. for 60 days, explaining how you do so.

8. OA and OB are the tangents from O to a circle. OA is 10 in. long and $\angle AOB = 76^\circ$. Calculate

- (i) the radius of the circle;
- (ii) the length of the chord AB .
- (iii) the distance of O from the nearest point of the circle;
- (iv) the length of the minor arc AB .

9. $ABCD$ is a field with straight sides. AB is 250 yd., AD 100 yd., and the angle A is 110° . The sides BC and CD are equal in length and the angle C is a right angle. Calculate the length DB to the nearest yard and the area of the field in acres.

[1 acre = 4,840 sq. yd.]

SUMMER EXAMINATION 1959

ALGEBRA

(2½ Hours)

Answer ALL questions from Section A and FOUR from Section B.

SECTION A

1. (i) If $a=1$, $b=2$, $c=-3$, find the value of $4b^2-3ac$.

(ii) Simplify $\frac{2a^4b^5c^2}{(-2abc)^3}$

(iii) Express $\frac{2a-3}{6a} - \frac{a-2}{4a}$ as a fraction in its lowest terms.

(iv) Solve the equation $\frac{2x-7}{3} - \frac{x-8}{5} = \frac{2}{3}$

2. (i) Factorize:

(1) $ab+2a-3b-6$;

(2) $5a^2-125b^2$.

(ii) Multiply $2x_2-5x-1$ by $3x-2$.

(iii) Given that $y=a\sqrt{x+bx}$, where a and b are constants and that $y=16$ when $x=4$, and also that $y=33$ when $x=9$, find the values of a and b , using only the positive values of \sqrt{x} .

3. (i) Solve the equation $4x^2=7$, giving the answer correct to two decimal places.

(ii) If $\frac{f}{g} = \frac{2P-W}{4P+W}$ find an expression for P in terms of the other letters.

(iii) ABC is a triangle in which $BC=5''$, $\angle ACB=90^\circ$, and $\angle ABC=35^\circ$. D is a point on BC , between B and C , such that $AD=4''$. Calculate the angle ADC and the length of DC .

SECTION B

Answer any FOUR questions from this section.

4. (i) Solve the equations

$$2x - y = 2.$$

$$4x^2 - 2xy + y^2 = 12.$$

(ii) The total force, P lb. wt., exerted by the wind on a given area is directly proportional to the square of the speed, V miles per hour, at which the wind is blowing. Find the percentage decrease in P if V decreases by 20 per cent.

5. (i) With the help of the Remainder Theorem, factorize

$$3x^3 - 10x^2 + 9x - 2.$$

- (ii) Find, without using tables, the values of

$$27^{\frac{1}{3}}; 12^0; 2^{-\frac{1}{3}} \times 2^{-\frac{2}{3}}.$$

- (iii) Use logarithms to find x if $x^{\frac{4}{3}} = 0.8$.

6. A tank can be filled by a tap A in 8 minutes longer than it takes to fill it by using another tap B . If the time taken to fill the tank by using tap B is t minutes and the time taken to fill the tank with both taps running together is $7\frac{1}{2}$ minutes, obtain an equation in t and solve it.

7. Using the same axes, draw the graphs of $y = \frac{12}{x}$ and $y = 15 - \frac{5x}{2}$ for values of x between $\frac{1}{2}$ and 6, taking 1 in. as unit on the x -axis and 1 in. as 5 units on the y -axis. Use your graphs to find the range of values of x for which $15 - \frac{5x}{2}$ is greater than $\frac{12}{x}$. Write down, and simplify, the equation which is satisfied by the values of x at the points of intersection of the two graphs.

8. (i) The 6th term of an arithmetic progression is 39 and the 12th term is 21. Find the first term, the common difference, and the sum of the first 20 terms.

(ii) The 5th term of a geometric progression is 32 and the 2nd term is 4. Find the first term and the common ratio.

(iii) Find the sum of the first 10 terms of a geometric progression whose first term is 2 and whose common ratio is $\frac{6}{5}$, using logarithms to evaluate your answer.

9. $ABCD$ is a quadrilateral, with AC as one diagonal, having the following dimensions:

$AB = 3''$, $BC = 2\frac{1}{2}''$, $CD = 4''$, $\angle ACD = 60^\circ$, and $\angle ADC = 70^\circ$. Calculate

- (i) the length of AC ;
- (ii) the size of the angle ABC ;
- (iii) the area of the triangle ABC .

SUMMER EXAMINATION, 1960

ORDINARY LEVEL

ARITHMETIC

 $(2\frac{1}{2}$ Hours)

Answer ALL questions from Section A and FOUR from Section B. The working by which you arrive at your results should be shown. Logarithms must NOT be used in Section A.

SECTION A

1. (i) Rose bushes are offered for sale at 4s. 9d. each, or 55s. per dozen. If a man buys 60 bushes, how much cheaper is the cost when reckoned at the dozen rate than when reckoned at the rate per bush?

(ii) Express $(2\frac{1}{4} - 1\frac{2}{3}) \div 1\frac{2}{3}$ as a single fraction in its lowest terms.

(iii) Find the value of $0.3 \times 70 \div \sqrt{0.04}$.

2. (i) Express 3150 as the product of its prime factors. What is the smallest whole number by which 3150 may be multiplied to give a perfect square?

(ii) A car driver who was overtaken by a second car estimated that 10 seconds after the second car had passed him it was 100 yards ahead. If he was driving at 33 m.p.h. what speed did his estimate attribute to the second car, to the nearest mile per hour?

(iii) A building society pays $3\frac{1}{2}$ per cent. per annum to members who lend it money. How much interest would be received in a year by a member who had lent £480?

3. A room is 18 ft. long, $13\frac{1}{2}$ ft. wide, and 12 ft. high. Calculate

(i) the area of the floor in sq. ft.,

(ii) the total area of the four walls in sq. ft.,

(iii) the cost of covering the floor completely with carpet costing £3. 5s. per sq. yd.,

(iv) the cost of the paint needed to cover the walls if it is bought in tins costing 9s. 6d. each, 1 tin being sufficient for 200 sq. ft.

[Neglect doors and windows.]

SECTION B

Answer FOUR questions from this section.

4. In a certain year the income tax paid by a married man without children was calculated as follows: Two-ninths of the total income plus a further sum of £240 were free of tax. The remainder of the income was called the taxable income and the first £50 of this was taxed at 2s. 3d. in the pound. On the next £150 the rate was 4s. 9d. in the pound; on the next £150 the rate was 6s. 9d., and on any further taxable income the full rate of 8s. 6d. was payable.

Calculate the tax paid by a married man without children whose income for the year was £1530. Express the tax as a percentage of the total income to the nearest whole number.

5. (i) A vessel in the shape of a circular cylinder whose axis is vertical contains water. The radius of the cylinder is 2 in. A sphere whose radius is 1 in. is lowered carefully into the water and is entirely immersed. Find how much the water level rises.

[The volume of a sphere is $\frac{4}{3}\pi \times$ the cube of the radius. If you use a value for π take it to be 3.14.]

(ii) Another measuring cylinder contains 250 c.c. of water and when 10 equal spherical marbles are immersed in the water the level of water rises to the 335 c.c. mark. Using logarithms, and taking $\log \pi = 0.4971$, calculate the radius of ONE of these marbles.

6. (i) By selling an article for £8 15s. a tradesman made a profit of 40 per cent. on his cost price. If he had sold the article for £6 10s. would he have gained or lost, and by what percentage of his outlay?

(ii) An assortment of biscuits is made by mixing them in the ratio of 5 lb. costing 1s. 6 $\frac{1}{2}$ d. per lb., 3 lb. costing 2s. 2d. per lb., and 1 lb. costing 2s. 8d. If 20 per cent. profit is made on the cost of the biscuits, find the selling price of a 7 lb. tin of the assortment, allowing 1s 6d. for the tin.

7. A train leaves a station *A* at noon and travels steadily at a speed of 35 miles per hour towards *B*, 90 miles away. In a travel graph, plot the positions of the train at noon and at 2 p.m. Take 2 in. to represent 1 hr., and 1 in. to represent 10 miles. Complete the graph and read from it the time at which the train reaches *B*.

A second train leaves *B* at 12.48 p.m. and travels non-stop to *A* at steady speed, arriving at 2.36 p.m. Draw its travel graph, and read from it the distance of this train from *B* after 1 hour's travel. Deduce the speed of this train in m.p.h.

At what time and how far from *A* do the two trains pass one another?

C is a station midway between *A* and *B*. Which train passes through *C* first, and how many minutes then elapse before the other train passes *C*?

[Record your answers clearly and indicate in your diagram how they are obtained.]

3060

$$\begin{array}{r} 19 \\ 15 \\ \hline 285 \end{array}$$

$$\begin{array}{r} 35 \\ 15 \\ \hline 50 \end{array}$$

$$\begin{array}{r} 27 \\ 5 \\ \hline 320 \end{array}$$

$$\begin{array}{r} 1530 \\ 580 \\ \hline 950 \end{array}$$

$$\begin{array}{r} 580 \\ 17 \\ \hline 597 \end{array}$$

$$\begin{array}{r} 11580 \\ 48 \\ \hline 216 \end{array}$$

346.875

16

8. A ladder, 16 ft. long, rests with its foot on level ground and its upper end at the top of a vertical wall 12 ft. high. What angle does the ladder make with the ground? ✓

The ladder is now adjusted so that it makes an angle of 65° with the ground, its upper end projecting over the top of the wall. Calculate how much the foot of the ladder has been moved nearer to the wall and what length of the ladder projects beyond the wall, each to the nearest inch.

How much nearer to the wall than before is the middle point of the ladder?

9. A and B are two observation posts on a straight stretch of coast. B is 5 miles due east of A . A lightship L bears $N 13^\circ E$ from B and $N 55^\circ E$ from A . Calculate the distance AL .

Y is a buoy which is 2 miles north of L . Calculate the distance AY .

SUMMER EXAMINATION, 1960

ORDINARY LEVEL

ALGEBRA

($2\frac{1}{2}$ Hours)

Answer ALL questions from Section A and FOUR from Section B.

SECTION A

1. (i) If $y = ax^2 + \frac{b}{x} - c$, find the value of y when $x = -2$, $a = 5$, $b = -4$, $c = 3$.

(ii) Simplify $\frac{7a^2b^2 - 14ab^3}{7ab}$.

(iii) Factorise $x^2 - ax - 5(x - a)$.

(iv) Solve the equations $2x + 5y = 8$
 $2x - 2y = -7$.

2. (i) Express $\frac{x^2 - 3}{3x} - \frac{x^2 - 5}{5x}$ as a fraction in its lowest terms.

(ii) Simplify $\frac{2x + 6}{x - 4} \times \frac{x^2 - 5x + 4}{x^2 - 9}$.

(iii) Solve the equation $\frac{5x + 6}{4} + x - \frac{2 - x}{6} = 6$.

3. (i) If y varies inversely as the square of x and if $y = 9$ when $x = 2$, find y in the terms of x .

(ii) Solve the equation $4x^2 - 3x - 2 = 0$, giving the answers correct to two decimal places.

(iii) ABC is a triangle in which $AB = 2''$, $BC = 1.328''$, and $\angle ABC = 90^\circ$. D is a point on AC such that BD is perpendicular to AC and E is a point on AB such that DE is perpendicular to AB . Calculate the angle BAC and the lengths of AD and DE .

SECTION B

4. (i) A motorist travelled from a town A to a town B . He covered the first 22 miles at a steady speed of 22 m.p.h. and for the remainder of the journey he maintained a steady speed of 40 m.p.h. His average speed for the whole journey was 32 m.p.h. Find the distance between the towns.

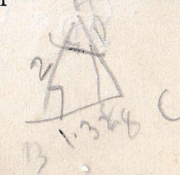
(ii) If $\frac{3(3a - x)}{b} = \frac{2(2b - x)}{a}$, find an expression for x in terms of a and b .

5. (i) Show that $x^2 - x - 6$ and $x^3 - 4x^2 + x + 6$ have a common factor and completely factorise the second expression.

(ii) If $p = 3 \times 10^8$ and $q = 5 \times 10^{-3}$, express $\frac{p}{q^2}$ in the form $a \times 10^n$, where n is a whole number and a lies between 1 and 10.

(iii) Use logarithms to evaluate x correct to 3 significant figures, given that $x^5 = (0.683)^3$.

6. A tradesman bought a number of yards of cloth for £55. He kept 3 yards, sold the remainder at 6s. 8d. per yard more than he gave, and received £5 more than he originally spent. How many yards of cloth did he buy?



7. Draw the graph of $y = x^2 + 4x$ for values of x between -5 and 1 , taking 1 in. as one unit on both axes. Use your graph (i) to write down the range of values of x for which the value of the expression $x^2 + 4x$ is less than -2 , and (ii) by drawing a suitable straight line graph, to solve the equation $x^2 + 3x = 3$.

8. (i) In an arithmetical progression the ratio of the 3rd term to the 7th term is $2:1$ and the sum of the first 6 terms is 45 . Find the first term and the common difference.

(ii) A machine was purchased on 1st January 1950 for £1000. During each year of its use, the value of the machine depreciates by 15% of its value at the beginning of the year. Write down an expression for the value of the machine on 1st January 1962 and evaluate this as accurately as the tables will allow.

9. Fig. 1 represents a framework of rods in which AX , CY are vertical and XY is horizontal. AB and BC are inclined at 48° and 64° to the vertical respectively; $AB = 12$ ft., $BC = 6$ ft., $CY = 8$ ft. Calculate the lengths, in feet, of AC and AX , giving each answer correct to two decimal places.

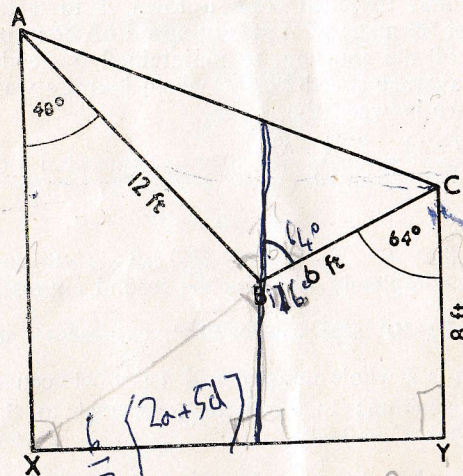


FIG. 1

$$S_n = \frac{n}{2} [2a + (n-1)d]$$

$$\frac{6 \cdot 10}{12} \times 3 = 8 \frac{1}{2} \times 7$$

$$3 \left(\frac{82 - x}{12} \right) = 8 \frac{1}{2} \times 7$$

SUMMER EXAMINATION 1961

ORDINARY LEVEL

MATHEMATICS

O a

ARITHMETIC

(2½ HOURS)

Answer ALL questions from Section A and FOUR from Section B. Show in your answers all the working by which you arrive at your results. If you fail to do this, you may lose marks.

Logarithms must NOT be used in Section A.

SECTION A

1. (i) Express $\frac{17}{64}$ as an exact decimal.
- (ii) Express $\frac{1}{3\frac{1}{3}} - \frac{1}{(2\frac{1}{2})^2}$ as a single fraction in its lowest terms.
- (iii) Multiply 1.56 by $2\frac{3}{4}$, giving the result as a decimal.
- (iv) Find the exact square root of 882.09 .

2. (i) One track of the tape of a tape-recorder plays for 80 minutes, the tape passing through the machine at $3\frac{3}{4}$ inches per second. Find the length of the tape in yards.

(ii) Copies of a certain booklet weigh 3 ounces each. What is the greatest number of them that may be packed into a parcel for posting if the parcel may not weigh more than 15 lb. and if $\frac{1}{2}$ lb. must be allowed for the weight of the wrapping?

(iii) A party of 36 children is to be supplied with packed lunches for a coach trip. Each child is to have a meat patty, two sandwiches, a packet of biscuits, an apple, and a bar of chocolate. The patties cost 7s. 6d. per dozen, the sandwiches 6s. 6d. per dozen, the biscuits 4d. per packet, the apples, which average six to the pound, cost 1s. 6d. per lb., and the chocolate $5\frac{1}{2}$ d. per bar. Find the total cost of the lunches.

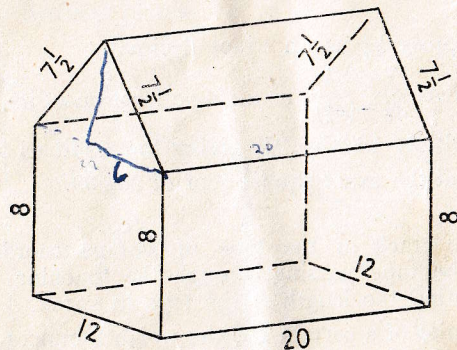
3. (i) Find the value of $4\frac{1}{2}$ per cent. of £270.
 (ii) A sum of money, lent at $2\frac{1}{2}$ per cent. per annum simple interest, amounted after 2 years to £257. 5s. What was the original sum of money?
 (iii) The average age of a form of 25 boys was 15 years 7 months and that of a second form of 30 boys was 16 years 6 months. What was the average age of the whole group of 55 boys?

SECTION B

Answer FOUR questions from this section.

4. (i) The figure illustrates a shed, dimensions being given in feet.

Calculate (a) the total area of its walls and roof in square feet, and (b) volume in cubic feet.



- (ii) A copper rolling mill transforms in less than a minute a rectangular bar of copper $4\frac{1}{4}$ in. by $4\frac{1}{4}$ in. by 50 in. into a cylindrical rod of diameter $\frac{1}{4}$ in. Assuming that there is no change of volume, find the length of the rod to the nearest yard. (Use logarithms and take the logarithm of π to be 0.4971.)

5. (i) The rateable value of my house is £56. What sum must I pay in a year in which a general rate of 23s. 6d. in the pound is levied? If at the same time my neighbour has to pay £70 10s. in rates on his house, what is its rateable value?

$\frac{25}{100} \times 12$

If the rateable value of the whole city is £2,560,000 what rate in the pound must be levied to pay for a development scheme estimated to cost the ratepayers £95,000? Give your answer to the nearest tenth of a penny.

- (ii) A man invested £2,310 in some $3\frac{1}{2}$ per cent. stock at 84. How much stock did he buy and what was the annual income from it?

6. (i) A cubic foot of mercury weighs 849 lb. Assuming that 1 Kg. = 2.20 lb. and that 1 in. = 2.54 cm., find an expression for the volume, in litres, occupied by 100 Kg. of mercury, and evaluate the expression correct to three significant figures. (1 litre = 1,000 c.c.)

- (ii) A shopkeeper bought apples at £6 per cwt. and sold them at 1s. 6d. per lb. Express his profit as a percentage of his outlay.

7. (i) The proportions by weight of potassium, oxygen, and hydrogen in caustic potash are 39 to 16 to 1 respectively. Find the weight, to the nearest gramme, of the potassium contained in 1 Kg. of caustic potash.

- (ii) A man wishes to have a mixture of 30 per cent. by volume of alcohol and 70 per cent. water in the radiator of his car, which has a capacity of 8 pints. He has a supply of a mixture of 40 per cent. alcohol and 60 per cent. water by volume. How much of this mixture should he use in his radiator, filling up with water?

8. A ship steaming at 15 knots in the direction S. 41° E. is at a point A at noon. How far South and how far East of A will the ship be at 1 p.m.? (1 knot = 1 nautical mile per hour.)

At this time the ship changes course and steams at the same speed in a direction N. 32° E. until it reaches a point B which is due East of A. How far is B from A, and at what time to the nearest minute, does the ship reach B?

9. The two hands of a clock are respectively 4.2 in. and 3.5 in. long.

- (i) What is the angle between them when the clock shows 3.45?

Handwritten calculations for Question 9(i):
 $4 \times \frac{28900}{7225} = 160$
 $\frac{160}{12} = 10.2$
 $56.25 \times \frac{15}{2} = 225$
 $225 - 10.2 = 214.8$
 $\frac{214.8}{10} = 21.48$
 Final answer: 21.48

(ii) What is the distance between the tips of the two hands when the angle between the hands is 137° ?

(iii) Calculate the angle between the hands when the distance between their tips is 3 inches.

ORDINARY LEVEL
MATHEMATICS

O b

ALGEBRA
(2½ HOURS)

Answer ALL questions from Section A and FOUR from Section B.

SECTION A

1. (i) Find the value of $y^2 - (x - 2z)$ when $x = 2$, $y = -3$, $z = -4$.

(ii) Simplify $\frac{3x}{2} \div \left(\frac{4x}{3}\right)^2$.

(iii) Simplify $q(p - 2q)^2 - p(p - 2q)(p + 2q)$.

(iv) Express $1 + \frac{3(x-2)}{2x} - \frac{x-1}{3x}$ as a fraction in its lowest terms.

2. (i) Factorise (1) $4x^2 - 12x + 9$,
(2) $2bx + 3by - a(2x + 3y)$,
(3) $16a^2 - 9b^2$.

(ii) Solve the equation $\frac{3(x-3)}{2} - \frac{2(x-2)}{3} = 1$.

(iii) Solve the equations $q = 1 - 2p$,
 $p = 8 - 2q$.

3. (i) Solve the equation $6x^2 - 2x - 3 = 0$, giving the answers correct to two decimal places.

(ii) If $i = \frac{E}{R + nr}$, find an expression for n in terms of the other letters.

(iii) Fig. 1 shows a trapezium $ABCD$ in which AB and DC are each perpendicular to BC . E is the mid point of AD and EF is drawn perpendicular to AD meeting DC in F .

If $AB = 12$ in. $BC = 9$ in., and $AD = 10$ in., calculate
(1) the angle ADC ,
(2) the length of EF ,
(3) the length of CD .

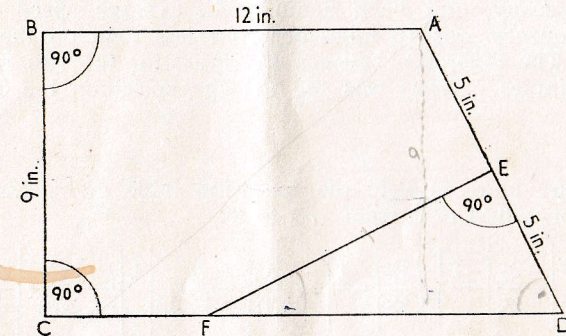


FIG. 1

SECTION B

Answer FOUR questions from this section..

4. (i) Solve the equations $3x - y = 2$,
 $9x^2 + y^2 - 14y + 4 = 0$.

(ii) The horse-power, H , of a ship's engine is directly proportional to the cube of the speed, V . If the horse-power necessary for a certain speed is 4000, find the horse-power necessary to increase this speed by 50%.

5. (i) If $2x - 1$ is a factor of $8x^3 + ax^2 - 4x + 1$, find the value of a , and find the other factor of the expression.

(ii) Express each of the following numbers as a power of 9:

729, 3, 1, $\frac{1}{3}$.

(iii) Use logarithm tables to calculate the value of

$$\frac{1}{\sqrt[3]{(0.0631)^4}}$$

Handwritten calculations for the logarithm problem:
 $162 \frac{110.00}{214.36} = 83.2489$
 $4a \ 43b \ 42a \ 36$
 $\frac{40}{139}$

6. (i) If $a = 1 - \frac{1}{b}$ and $b = 1 + \frac{2}{c}$, express a in terms of c , reducing your answer to its simplest form.

(ii) A motorist travelled from a town A to a town B , 100 miles away, and back again. His average speed on the outward journey was 10 miles per hour less than on the return journey. The difference between the times for the two journeys was 50 minutes. What was the average speed on the outward journey?

7. Copy and complete the following table giving values of $\frac{1}{3}x^3 - 3x$ for values of x from -3 to 3 :

x	-3	$-2\frac{1}{2}$	-2	$-1\frac{1}{2}$	-1	$-\frac{1}{2}$	0	$\frac{1}{2}$	1	$1\frac{1}{2}$	2	$2\frac{1}{2}$	3
$\frac{1}{3}x^3 - 3x$	0	2.29		3.38		1.46	0	-1.46		-3.38		-2.29	0

Using the same axes, draw the graphs of $y = \frac{1}{3}x^3 - 3x$ and $y = 1 - \frac{1}{3}x$ for values of x between -3 and 3 , taking 1 in. as unit on each axis.

Use your graphs to find the ranges of values of x for which $\frac{1}{3}x^3 - 3x$ is less than $1 - \frac{1}{3}x$.

Write down, and simplify, the equation which is satisfied by the values of x at the points of intersection of the two graphs.

8. (i) The 19th term of an arithmetic progression is 24 and the sum of the first 20 terms is 140. Find the first term and the common difference.

(ii) The first term of a geometric progression is 2 and the fourth term is $\frac{125}{8}$. Find the common ratio and the sum of the first 9 terms using logarithms to evaluate your answer.

9. Fig. 2 shows a quadrilateral $ABCD$ in which $AB = 8$ in., $BC = 5$ in., $CD = 12$ in., the angle $ABC = 120^\circ$, and the angle $BCD = 110^\circ$.

Calculate (1) the length of AC ,
(2) the angle BCA ,
(3) the area of the triangle ACD .

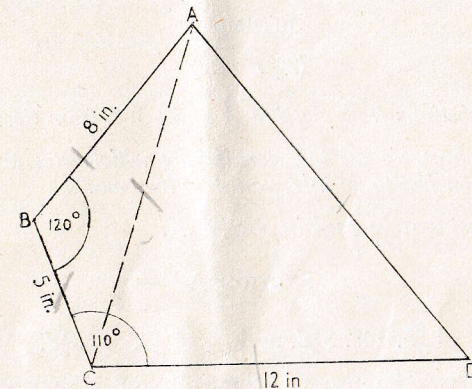


FIG. 2

$$S = \frac{n}{2}(a+l)$$

$$T_n = a + (n-1)d$$

$$S = \frac{n}{2}(a+n-1)d$$

$$140 = 10(9 +$$

[Handwritten scribbles]

[Handwritten scribbles]

SUMMER EXAMINATION, 1962

ORDINARY LEVEL

MATHEMATICS

O a

ARITHMETIC

(2½ Hours)

Answer ALL questions from Section A and FOUR from Section B.

Show in your answers all the working by which you arrive at your results. If you fail to do this, you may lose marks.

Logarithms must NOT be used in Section A.

SECTION A

1. (i) To $\frac{9}{13}$ of £5. 14s. 3½d. add $\frac{9}{13}$ of £7. 5s. 8½d.
 - (ii) Find, by the use of prime factors, the smallest whole number by which 97,020 must be multiplied to make it a perfect square.
 - (iii) Simplify $2\frac{3}{4} - \left(1\frac{7}{8} \div \frac{1}{15}\right)$.
 - (iv) Anne has 6s. 10d., and Christine has 8s. 8d. How much must Anne give to Christine, so that Christine will have three times as much as Anne?
2. (i) The average daily sales of a newspaper from Monday to Friday inclusive were 418,275, and from Monday to Saturday inclusive the average figure was 420,810. Express the number of copies sold on Saturday as a percentage (correct to one place of decimals) of the average daily sales during the rest of the week.
 - (ii) Taking $\pi = 3\frac{1}{7}$, find the volume in cubic feet of a circular cylinder of diameter 4 ft. 8 in. and height 6 ft. 9 in.
 - (iii) Find by how much the compound interest on £750 for 2 years at 6 per cent. per annum exceeds the simple interest.

3. (i) Sand, after having been excavated, is sifted, and 2 cwt. 16 lb. of stones are removed from each ton of sand. What weight of stones will be removed from 47 tons 16 cwt. 3 qr. of excavated sand?

(ii) Electricity is charged at 5·75d. a unit for the first 84 units used, and 1·05d. a unit for the remaining units used. If my bill is £6. 3s. 4½d., how many units of electricity have I used?

(iii) The four pistons of a car travelling at 30 m.p.h. make a total of 315 strokes per second. Find the number of strokes per minute made by each piston when the car is travelling at 56 m.p.h.

SECTION B

Answer any FOUR questions from this section.

4. A swimming bath is 50 yd. long and 15 yd. wide. The depth of the water increases uniformly from 3 ft. at the shallow end to 7 ft. at the deep end. The bath is filled in $2\frac{1}{4}$ hours from a circular inlet pipe, from which the water issues, full bore, at 3 ft. per second. Find the radius of the inlet pipe, in inches, correct to two significant figures. If the water can be emptied from the bath in $2\frac{1}{2}$ hours, how long will it be before half the floor of the swimming bath is exposed? (Take $\log \pi = 0\cdot4972$.)

5. Geoffrey and Michael wish to make a journey, starting at noon, from a town P to a town Q, 16 miles away. Having only one bicycle, they agree that Geoffrey will first ride half way, leave the bicycle, and walk the remainder of the distance, while Michael will walk the first half distance, pick up the bicycle, and ride the remainder of the distance. They both ride at 12 m.p.h. and walk at 4 m.p.h. However, when Michael is riding, the bicycle breaks down after 15 minutes, so he immediately pushes the bicycle the remainder of the distance at 3 m.p.h. Taking 1 in. to represent 2 miles, and 2 in. to represent 1 hour, draw graphs representing their journeys and find from the graphs

- (i) How much later Michael reached Q than he would have done without the breakdown.
- (ii) How far Geoffrey was ahead of Michael when the breakdown occurred.
- (iii) If, after waiting 15 minutes at Q, Geoffrey had walked back at 4 m.p.h., where would they have met?

6. A garage owner wishes to fill certain drums with a mixture of three grades of oil, A , B , and C , which weigh respectively 8.8 lb., 8.85 lb., and 8.9 lb. per gallon. The mixture of oils weighs 6,714 lb., and contains, by volume, twice as much grade A as grade B , and two and a half times as much grade A as grade C . Find the volumes in gallons of the different grades contained in the mixture.

If grade A oil costs him 12s. per gallon, grade B costs 9s. 4d. per gallon, and grade C costs 8s. 4d. per gallon, at what price per pint must he sell the mixture to make 33 per cent. profit on his outlay?

7. (i) A book which costs 4.5 marks in West Germany is sold in France for 5.28 francs. Which is the higher price, and by how much? Give your answer in pence correct to one decimal place ($\text{£}1 = 11.20 \text{ marks} = 13.96 \text{ francs}$).

(ii) A shopkeeper marks his goods at a price which would give him a profit of 44 per cent. on his outlay, but he allows his customers a discount of 1d. in the shilling on the marked price. What is the marked price of an article on which the profit is 10s. 8d. after allowing discount?

8. Fig. 1 illustrates a section of a roof frame, AB being horizontal. If the angles of elevation of C , from A and from B , are 42° and 31° respectively, if the girder CB is 14 ft. long, and the vertical member CD is 3 ft. long, calculate

- the length of the span AB ;
- the angle of elevation of D from A ;
- the length of AD .

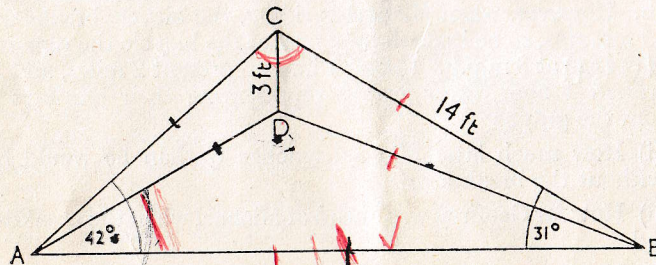


FIG. 1

9. In Fig. 2 PQR represents a mechanical excavator. The bucket arm, QR , is hinged at Q to the jib PQT , so that the bucket may scoop the ground between S and R . When PQT is inclined at 27° to the horizontal it is found that angle $QRS = 64^\circ$. The bucket arm QR is 12 ft. long, and QT is 8 ft. long. Calculate

- the height, QN , of Q above ground level;
- the length of PQ in feet and inches, correct to the nearest inch;
- the length of the rope, TS , when the bucket is at S , giving your answer in feet, correct to three significant figures.

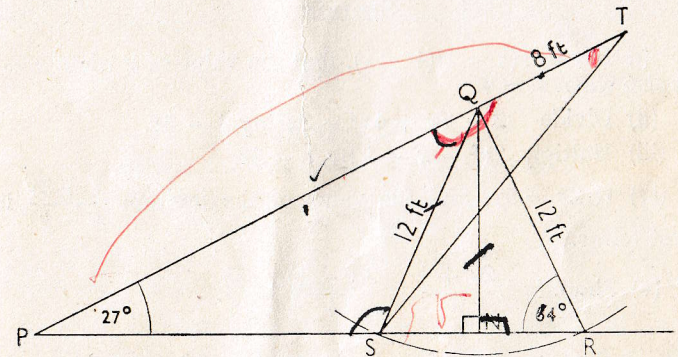


FIG. 2

ORDINARY LEVEL

MATHEMATICS

O b

ALGEBRA

 $(2\frac{1}{2}$ Hours)

Answer ALL questions from Section A and FOUR from Section B.

All working must be shown in the answer book.

SECTION A

1. (i) If $y = 3(x - 1)(4 - x)$, find the value of y when $x = -1$ and also when $x = 4$.

(ii) Divide $2 - 7x + 4x^2 - 3x^3$ by $1 - 3x$.

(iii) Multiply $2x^2 - x - 1$ by $1 - 5x$.

(iv) If $2x = 5y$, find the value of the fraction $\frac{x + 2y}{x - y}$ in its lowest terms.

(v) Simplify $\frac{2a + b}{3} - \frac{3a - 2b}{4} - \frac{5b}{6}$.

2. (i) Factorise (a) $2a + 3b - 2ac - 3bc$,
(b) $2x^3 - 18x$.

(ii) Write down the square root of $x^4 - 6x^2 + 9$.

(iii) If $6x - 13y = x - 3y$, find the ratio of x to y .

(iv) Solve the equation $\frac{x - 4}{2} - \frac{1 - x}{7} = 3$.

3. (i) Solve the equations $3x - 2y - 3 = 0$,
 $y = 2(x + 1)$.

(ii) Solve the equation $2x(x - 3) = 1$, giving the answers correct to two decimal places.

(iii) Fig. 1 shows a triangle ABC in which AD is perpendicular to BC , $DC = 10$ in., the angle $ACD = 40^\circ$, and the angle $BAC = 118^\circ 20'$.

Calculate (a) the length of AD ,
(b) the length of AB ,
(c) the perpendicular distance of D from AB .

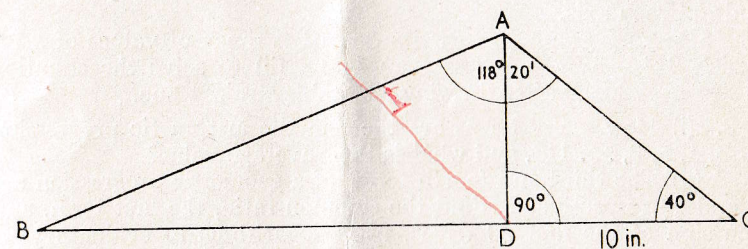


FIG. 1

SECTION B

Answer FOUR questions from this section.

4. (i) Solve the equations $2x + y = -1$,
 $x^2 + 2y^2 + 3x - 8y + 8 = 0$.

(ii) If $x(a - x) - x(b - x) = (x - a)^2 - (x - b)^2$, find an expression for x in terms of a and b .

5. (i) Find, without using tables, the value of $\sqrt[3]{4} \times 4\frac{1}{6}$.

(ii) The distance, d miles, of an observer's horizon at sea is directly proportional to the square root of the height, h feet, of the observer above sea level. If, from a height of 64 feet above sea level the distance of the visible horizon is 10 miles, how much higher must the observer be in order to increase the distance of the visible horizon by 5 miles?

(iii) If when the expression $x^3 - 4x^2 + x + k$ is divided by $x - 1$, the remainder is 4, what is the value of k ? Using this value of k , show that $x - 2$ is a factor of the expression and hence factorise the expression completely.

6. (i) Use logarithm tables to calculate the value of $\sqrt[5]{(0.00216)^2}$.

(ii) A man purchased a number of articles for £60. If, however, the cost price of each article had been increased by 2s. 6d., the number of articles received would have been reduced by 2. How many articles did he purchase and what was the cost price of each?

7. Calculate the value of $2x^2 - 3x - 1$ for each of the following values of x : -2 , -1 , $-\frac{1}{2}$, 0 , $\frac{1}{2}$, 1 , 2 , 3 , and draw the graph of $y = \frac{1}{2}(2x^2 - 3x - 1)$ in the range $x = -2$ to 3 , taking 1 inch as unit on each axis.

Use your graph (i) to write down the range of values of x for which $2x^2 - 3x - 1$ is less than 1 and (ii) to solve the equation $2x^2 - x - 2 = 0$ after drawing a suitable straight line.

8. (i) How many terms are there in the arithmetic progression $-3, 1, 5, 9, \dots, 113$, and what is their average value?

(ii) The third and fourth terms of a geometric progression are $\frac{8}{9}$ and $\frac{32}{27}$ respectively. Find the common ratio, the first term, and the sum of the first 20 terms, using logarithms to evaluate your answer.

9. In Fig. 2, $AB = 15$ in., $BC = 23$ in., $CA = 14$ in., the angle $ABD = 30^\circ$, and $BD = 24$ in.

- Calculate
- the angle BAC ,
 - the area of the triangle ABC ,
 - the area of the concave polygon $BACD$.

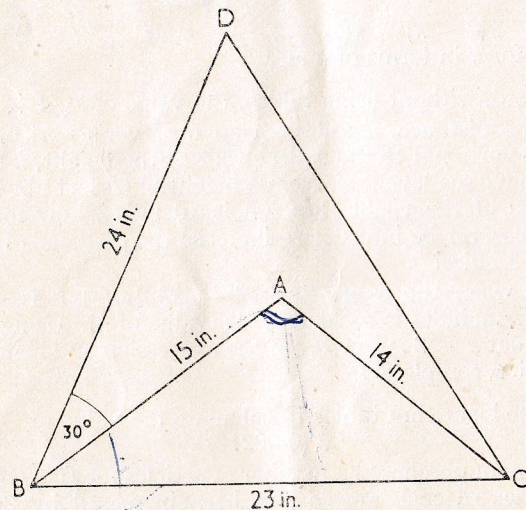


FIG. 2

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