# 1 Problems public WAEC math 2019 By cheetahwaec.com

## Problem 1

(a) Solve the inequality  $\frac{1+4x}{2} - \frac{5+2x}{7} < x-2$ . Represent solution as inequality  $x < \alpha$ , where  $\alpha$  is a decimal number. Give the answer as  $\alpha$ . (b) If x : y = 3 : 5, find the value of  $\frac{2x^2 - y^2}{y^2 - x^2}$ . Represent solution as  $\frac{\alpha}{\beta}$ , give the answer as  $\alpha, \beta$ .

## Problem 2

The second, fourth and sixth terms of an arithmetic progression are x-1, x+1 and 7 respectively. Find the: (a) common difference;

- (b) first term;
- (c) value of x.

## Problem 3



- (a) If  $log_{10}$  a = 1.3010 and  $log_{10}$  b = 1.4771, find, correct to one decimal place, the value of ab. (b) In the diagram below, O is the centre of the circle,  $\angle ACB = 39^{\circ}$  and  $\angle CBE = 62^{\circ}$ . Find:
- (i) the interior angle AOC;
- (ii) angle BAC.

## Problem 4

(a) Without using mathematical tables or calculator, simplify and give the the answer as a decimal number:  $\frac{\log_2 8 + \log_2 16 - 4 \log_2 2}{\log_4 16}$ . (b) If  $1342_{\text{five}} - 241_{\text{five}} = x_{\text{ten}}$ , find the value of x.

## Problem 5

The cost of dinner for a group of tourist is partly constant and partly varies as the number of tourists present. It costs \$740.00 when 20 tourists were present and \$960.00 when the number of tourists increased by 10. Find the cost of the dinner when only 15 tourists were present.

## Problem 6

(a) Fred bought a car for \$5,600.00 and later sold it at 90% of the cost price. He spent \$1,310.00 out of the amount received and invested the rest at 6% per annum simple interest. Calculate the interest earned in 3 years. Give the answer as a decimal number. (b) Solve the equations  $2^{x} (4^{-7}) = 2$  and  $3^{-x} (9^{2y}) = 3$  simultaneously. Write the answer as (x, y).





In the diagram below, there is a chord of a circle with centre 0. |MN| is 22 .42 cm and the perimeter of triangle MON is 55.6 cm. Calculate, correct to the nearest degree,  $\angle MON$ . (b) T is equidistant from P and Q. The bearing of P from T is 60° and the bearing of Q from T is 130°.

- (i) Illustrate the information on a diagram.
- (ii) Find the bearing of Q from P.

## Problem 8

The ages of a group of athletes are as follows: 18, 16.18, 20, 17, 16, 19, 17, 18, 17 and 15. A. Find the range of the distribution.

- B. Draw a frequency distribution table for the data.
- C. What is the median age?
- D. Calculate, correct to two decimal places, the:
- (i) mean age.
- (ii) standard deviation.

#### Problem 9

A survey of 40 students showed that 23 students study Mathematics, 5 study Mathematics and Physics, 8 study Chemistry and Mathematics, 5 study Physics and Chemistry and 3 study all the three subjects. The number of students who study Physics only is twice the number who study Chemistry only. (a) Find the number of students who study:

- (i) only Physics.
- (ii) only one subject.

b) What is the probability that a student selected at random studies exactly 2 subjects? Give

the answer as a decimal number.

## Problem 10

A. A twenty kilogram bag of rice is consumed by m number of boys in 10 days. When four more boys joined them, the same quantity of rice lasted only 8 days. If the rate of consumption is the same, find the value of m. B. Suppose that  $\frac{5}{6}$  of a number is 10 greater than  $\frac{1}{3}$  of it, find the number.

C. Find the equation of the line which passes through the points  $(2, \frac{1}{2})$  and  $(-1, -\frac{1}{2})$ . Represent solution as ax + by + c = 0. Give the answer in the form of a, b, c.

## Problem 11

A ladder 11 m long leans against a vertical wall at an angle of  $75^{\circ}$  to the ground. The ladder is the pushed 0.2 m up the wall. (a) Illustrate the information in a diagram.

(b) Find correct to the nearest whole number:

(i) The new angle which the ladder makes with the ground.

(ii) The distance the foot of the ladder has moved from its original position.

## Problem 12

(a) Copy and complete the table of values for the relation  $y = 4x^2 - 8x - 21$ , for  $-2.0 \le x \le 4.0$ . Give the answer as a sequence of decimal numbers.



(b) Using a scale of 2 cm to 1 unit on the x-axis and 2 cm to 5 units on the y-axis, draw the graph for the relation  $y = 4x^2 - 8x - 21$ .

(ii) Use the graph to find, within  $\pm 1$  margin, the solution set of:

 $A.4x^2 - 8x = 3$ . Give the ansewr as an increasing sequence of decimal numbers.

 $B.4x^2 - 7x - 21 = 0$ . Give the ansewr as an increasing sequence of decimal numbers.

## Problem 13

(a) The curved surface areas of two cones are equal. The base radius of one is 5 cm and its slant height is 12 cm. Calculate the height of the second cone if its base radius is 6 cm. (b) Given the matrices  $A = \begin{pmatrix} 2 & 5 \\ -1 & -3 \end{pmatrix}$  and  $B = \begin{pmatrix} 3 & -2 \\ 4 & 1 \end{pmatrix}$ , find:

(i) BA. Give the answer as a sequence of a matrix elements  $a_{11}, a_{12}, a_{21}, a_{22}$ .

(ii) The determinant of BA.

#### Problem 14

(a) Given that  $110_x = 40_{\text{five}}$ , find the value of x. (b) Simplify  $\frac{15}{\sqrt{75}} + \sqrt{108} + \sqrt{432}$ . Represent solution as  $a\sqrt{b}$ , where a and b are positive integers, give the answer in the from of a, b.

## Problem 15



(a) In the diagram, RS and RT are tangent to the circle with centre O,  $\angle TUS = 68^{\circ}, \angle SRT = x$ and  $\angle \text{UTO} = y$ . Find the value of x. (b) Two tanks A and B are filled to capacity with diesel. Tank A holds 600 litres diesel more than tank B. If 100 litres of diesel was pumped cut of each tank, tank A would then contain 3 times as much as tank B. (i) Find the capacity of tank A. (ii) Find the capacity of tank B.

#### Problem 16

Express, correct to three significant figures, 0.003597. Possible answers: A. 0.359; B. 0.004; C. 0.00360;D. 0.00359

#### Problem 17

Evaluate:  $(0.064)^{-\frac{1}{3}}$ . Possible answers: A.  $\frac{5}{2}$ ;B.  $\frac{2}{5}$ ;C.  $-\frac{2}{5}$ ;D.  $-\frac{5}{2}$ 

Problem 18 Solve:  $\frac{y+1}{2} - \frac{2y-1}{3} = 4$ . Possible answers: A. y = 19;B. y = -19;C. y = -29;D. y = 29Problem 19

Simplify, correct to three significant figures,  $(27.63)^2 - (12.37)^2$ . Possible answers: A. 614;B. 612;C. 611;D. 610

If  $7 + y = 4 \pmod{8}$ , find the least value of  $y, 10 \le y \le 30$ . Possible answers: A. 11;B. 13;C. 19:D. 21

## Problem 21

If  $T = \{ \text{ prime numbers } \}$  and  $M = \{ \text{ odd numbers } \}$  are subsets of  $\mu = \{x : 0 < x \leq 10\}$ and x is an integer, find  $(T' \cap M')$ . Possible answers: A.  $\{4, 6, 8, 10\}$ ; B.  $\{1.4, 6, 8, 10\}$ ; C.  $\{1, 2, 4, 6, 8, 10\};$ D.  $\{1, 2, 3, 5, 7, 8, 9\}$ 

#### Problem 22

Evaluate:  $\frac{\log_3 9 - \log_2 8}{\log_3 9}$ . Possible answers: A.  $-\frac{1}{3}$ ; B.  $\frac{1}{2}$ ; C.  $\frac{1}{3}$ ; D.  $-\frac{1}{2}$ 

## Problem 23

If  $23_y = 1111_{\text{two}}$ , find the value of y. Possible answers: A. 4;B. 5;C. 6;D. 7

## Problem 24

If 6, P, and 14 are consecutive terms in an arithmetic progression, find the value of P. Possible answers: A. 9;B. 10;C. 6;D. 8

Problem 25

Evaluate:  $2\sqrt{28} - 3\sqrt{50} + \sqrt{72}$ . Possible answers: A.  $4\sqrt{7} - 21\sqrt{2}$ ; B.  $4\sqrt{7} - 11\sqrt{2}$ ; C.  $4\sqrt{7} - 9\sqrt{2}$ ; D.  $4\sqrt{7} + \sqrt{2}$ 

## Problem 26

If m : n = 2 : 1, evaluate  $\frac{3m^2-2n^2}{m^2+mn}$ . Possible answers: A.  $\frac{4}{3}$ ;B.  $\frac{5}{3}$ ;C.  $\frac{3}{4}$ ;D.  $\frac{3}{5}$ Problem 27

*H* varies directly as *p* and inversely as the square of *y*. If H = 1, p = 8 and y = 2, find *H* in terms of p and *y*. Possible answers: A.  $H = \frac{p}{4y^2}$ ; B.  $H = \frac{2p}{y^2}$ ; C.  $H = \frac{p}{2y^2}$ ; D.  $H = \frac{p^2}{y^2}$ 

## Problem 28

Solve  $4x^2 - 16x + 15 = 0$ . Possible answers: A.  $x = 1\frac{1}{2}$  or  $x = -2\frac{1}{2}$ ; B.  $x = 1\frac{1}{2}$  or  $x = 2\frac{1}{2}$ ; C.  $x = 1\frac{1}{2}$  or  $x = -1\frac{1}{2}$ ; D.  $x = -1\frac{1}{2}$  or  $x - 2\frac{1}{2}$ **Problem 29** 

Simplify:  $\log_{10} 6 - 3 \log_{10} 3 + \frac{2}{3} \log_{10} 27$ . Possible answers: A.  $3 \log_{10} 2$ ; B.  $\log_{10} 2$ ; C.  $\log_{10} 3$ ; D.  $2\log_{10} 3$ 

## Problem 30

Bala sold an article for N6,900.00 and made a profit of 15%. Calculate his percentage profit if he had sold it for N6,600.00. Possible answers: A. 5%; B. 10%; C. 12%; D. 13% Problem 31

If 3p = 4q and 9p = 8q - 12, find the value of pq. Possible answers: A. 12;B. 7;C. -7;D. -12 Problem 32

If  $(0.25)^y = 32$ , find the value of y. Possible answers: A.  $y = -\frac{5}{2}$ ; B.  $y = -\frac{3}{2}$ ; C.  $y = \frac{3}{2}$ ; D.  $y = \frac{5}{2}$ Problem 33

There are 8 boys and 4 girls in a lift. What is the probability that the first person who steps out of the lift will be a boy? Possible answers: A.  $\frac{1}{6}$ ; B.  $\frac{1}{4}$ ; C.  $\frac{2}{3}$ ; D.  $\frac{1}{2}$ 

Problem 34 Simplify:  $\frac{x^2-5x-14}{x^2-9x+14}$ . Possible answers: A.  $\frac{x-7}{x+7}$ ; B.  $\frac{x+7}{x-7}$ ; C.  $\frac{x-2}{x+4}$ ; D.  $\frac{x+2}{x-2}$ Problem 35

Which of these values would make  $\frac{3p-1}{p^2-p}$  undefined? Possible answers: A. 1;B.  $\frac{1}{3}$ ;C.  $-\frac{1}{3}$ ;D. -1 Problem 36

The total surface area of a solid cylinder  $165\ {\rm cm}^2.$  Of the base diameter is  $7\ {\rm cm}$  , calculate its height. [Take  $\pi = \frac{22}{7}$ ] Possible answers: A. 7.5 cm;B. 4.5 cm;C. 4.0 cm;D. 2.0 cm Problem 37

If  $2^a = \sqrt{64}$  and  $\frac{b}{a} = 3$ , evaluate  $a^2 + b^2$ . Possible answers: A. 250;B. 160;C. 90;D. 48 **Problem 38** Problem 38



In  $\triangle XYZ$ , |YZ| = 32 cm,  $\angle YXZ = 52^{\circ}$  and  $\angle XZY = 90^{\circ}$ . Find, correct to the nearest centimetre, |XZ|. Possible answers: A. 31 cm;B. 25 cm;C. 20 cm;D. 13 cm

## Problem 39

If  $\log_x 2 = 0.3$ , evaluate  $\log_x 8$ . Possible answers: A. 2.4;B. 1.2;C. 0.9;D. 0.6

## Problem 40

An arc subtends an angle of  $72^{\circ}$  at the centre of a circle. Find the length of the arc if the radius of the circle is 3.5 cm . [Take  $\pi = \frac{22}{7}$ ] Possible answers: A. 6.6 cm;B. 8.8 cm;C. 4.4 cm;D. 2.2  $\mathrm{cm}$ 

## Problem 41

Make *b* the subject of the relation  $lb = \frac{1}{2}(a+b)h$ . Possible answers: A.  $\frac{ah}{2l-h}$ ; B.  $\frac{2l-h}{al}$ ; C.  $\frac{al}{2l-h}$ ; D.  $\frac{al}{2l-h}$ ; D.  $\stackrel{al}{\stackrel{2-h}{\mathbf{Problem}}}\mathbf{42}$ 

Eric sold his house through an agent who charged 8% commission on the selling price. If Eric received \$117,760.00 after the sale, what was the selling price of the house? Possible answers: A. \$130,000.00; B. \$128,000.00; C. \$125,000.00; D. \$120,000.00

## Problem 43

Find the angle at which an arc of length 22 cm subtends at the centre of a circle of radius 15 cm . [Take  $\pi = \frac{22}{7}$ ] Possible answers: A. 70°;B. 84°;C. 96°;D. 156°

## Problem 44

A rectangular board has a length of 15 cm and width x cm . If its sides are doubled, find its new area. Possible answers: A. 60xcm<sup>2</sup>;B. 45xcm<sup>2</sup>;C. 30xcm<sup>2</sup>;D. 15xcm<sup>2</sup> Problem 45



In the diagram below, POS and ROT are straight lines. OPQR is a parallelogram, |OS| = |OT| and  $\angle OST = 50^{\circ}$ . Calculate the value of  $\angle OPQ$ . Possible answers: A. 100°;B. 120°;C. 140°;D. 160°

#### Problem 46

Factorize completely: (2x+2y)(x-y)+(2x-2y)(x+y). Possible answers: A. 4(x-y)(x+y);B. (4(x-y);C. 2(x-y)(x+y);D. 2(x-y))

#### Problem 47

The interior angles of a polygon are  $3x^{\circ}, 2x^{\circ}, 4x^{\circ}, 3x^{\circ}$  and  $6x^{\circ}$ . Find the size of the smallest angle of the polygon. Possible answers: A.  $80^{\circ}$ ; B.  $60^{\circ}$ ; C.  $40^{\circ}$ ; D.  $30^{\circ}$ 

#### Problem 48

A box contains 2 white and 3 blue identical balls. If two balls are picked at random from the box, one after the other with replacement, what is the probability that they are of different colours? Possible answers: A.  $\frac{2}{3}$ ;B.  $\frac{3}{5}$ ;C.  $\frac{7}{20}$ ;D.  $\frac{12}{25}$ 

## Problem 49

Find the equation of a straight line passing through the point (1, -5) and having gradient of  $\frac{3}{4}$ . Possible answers: A. 3x + 4y - 23 = 0; B. 3x + 4y + 23 = 0; C. 3x - 4y + 23 = 0; D. 3x - 4y - 23 = 0**Problem 50** 

The foot of a ladder is 6 m from the base of an electric pole. The top of the ladder rest against the pole at a point 8 m above the ground. How long is the ladder? Possible answers: A. 14m;B. 12m;C. 10m;D. 7m

## Problem 51

If  $\tan x = \frac{3}{4}, 0 < x < 90^{\circ}$ , evaluate  $\frac{\cos x}{2 \sin x}$ . Possible answers: A.  $\frac{8}{3}$ ; B.  $\frac{3}{2}$ ; C.  $\frac{4}{3}$ ; D.  $\frac{2}{3}$ **Problem 52** 

From the top of a vertical cliff 20 m high, a boat at sea can be sighted 75 m away and on the same horizontal position as the cliff. Calculate, correct to the nearest degree, the angle of depression of the boat from the top of the cliff. Possible answers: A. 56°;B. 75°;C. 16°;D. 15° **Problem 53** 



In the diagram, O is the centre of the circle of radius 18 cm . If  $\angle ZXY = 70^{\circ}$ , calculate the length of arc ZY. [Take  $\pi = \frac{22}{7}$ ] Possible answers: A. 11 cm;B. 22 cm;C. 44 cm;D. 80 cm **Problem 54** 



In the diagram, RT is a tangent to the circle at R,  $\angle PQR = 70^{\circ}$ ,  $\angle QRT = 52^{\circ}$ ,  $\angle QSR = y$  and  $\angle PRQ = x$ . Find the value of y. Possible answers: A.  $70^{\circ}$ ; B.  $60^{\circ}$ ; C.  $52^{\circ}$ ; D.  $18^{\circ}$ **Problem 55** 



In the diagram, RT is a tangent to the circle at R,  $\angle PQR = 70^{\circ}$ ,  $\angle QRT = 52^{\circ}$ ,  $\angle QSR = y$  and  $\angle PRQ = x$ . Find the value of x. Possible answers: A.  $70^{\circ}$ ; B.  $58^{\circ}$ ; C.  $52^{\circ}$ ; D.  $18^{\circ}$ **Problem 56** 

Calculate the variance of 2, 4, 7, 8 and 9. Possible answers: A. 7.2; B. 6.8; C. 3.5; D. 2.6 **Problem 57** 

The fourth term of an arithmetic progression is 37 and the first term is -20. Find the common difference. Possible answers: A. 3;B. 57;C. 19;D. 17



In the diagram, PQ is parallel to RS,  $\angle QFG = 105^{\circ}$  and  $\angle FEG = 50^{\circ}$ . Find the value of m. Possible answers: A. 130°;B. 105°;C. 75°;D. 55°



In the diagram, PQ is parallel to RS,  $\angle QFG = 105^{\circ}$  and  $\angle FEG = 50^{\circ}$ . Find the value of n. Possible answers: A. 40°; B. 55°; C. 75°; D. 130° **Problem 60** 

A box contains 5 red, 6 green and 7 yellow pencils of the same size. What is the probability of picking a green pencil at random? Possible answers: A.  $\frac{1}{6}$ ;B.  $\frac{1}{4}$ ;C.  $\frac{1}{3}$ ;D.  $\frac{1}{2}$ **Problem 61** 



The pie chart represents fruits on display in a grocery shop. If there are 60 oranges on display, how many apples are there? Possible answers: A. 90;B. 80;C. 70;D. 40

## Problem 62

The following are scores obtained by some students in a test. Find the mode of the distribution.



Possible answers: A. 18;B. 14;C. 13;D. 8

## Problem 63

The following are scores obtained by some students in a test. Find the median score.



Possible answers: A. 14.5; B. 14.0; C. 13.5; D. 13.0

## Problem 64

The following are scores obtained by some students in a test: 8, 18, 10, 14, 18, 11, 13, 14, 13, 17, 15, 8, 16, and 13

How many students scored above the mean score? Possible answers: A. 10;B. 9;C. 8;D. 7

#### Problem 65

Evaluate:  $\frac{0.42 \div 2.5}{0.5 \times 2.05}$ , leaving the answer in the standard form. Possible answers: A.  $1.639 \times 10^2$ ;B.  $1.639 \times 10^1$ ;C.  $1.639 \times 10^{-1}$ ;D.  $1.639 \times 10^{-2}$ 

## Problem 66

(a) Find the equation of the line which passes through the points A(-2,7) and B(2,-3). Represent solution as ax + by + c = 0. Write the answer as a, b, c. (b) Given that  $\frac{5b-a}{8b+3a} = \frac{1}{5}$ , find, correct to two decimal places, the value  $\frac{a}{b}$ .

#### Problem 67

(a) Ali, Musah and Yusif shared N 420.000.00 in the ratio 3:5:8 respectively. Find the sum of Ali and Yusuf's shares. (b) Solve:  $2\left(\frac{1}{8}\right)^x = 32^{x-1}$ . Give the answer as a decimal number.

## Problem 68



In the diagram, PQRS is a quadrilateral,  $\angle PQR = \angle PRS = 90^{\circ}$ , |PQ| = 3 cm, |QR| = 4 cm and |PS| = 13 cm. Find the area of the quadrilateral.

## Problem 69

Three red balls, five green balls, and a number of blue balls are put together in a sack. One ball is picked at random from the sack. If the probability of picking a red ball is  $\frac{1}{6}$  find: (a) The number of blue balls in the sack.

(b) the probability of picking a green ball. Give the answer as a decimal number rounded to three decimal places.

## Problem 70

The force of attraction F, between two bodies, varies directly as the product of their masses,  $m_1$  and  $m_2$  and inversely as the square of the distance, d, between them. Given that F = 20 N, when  $m_1 = 25$  kg,  $m_2 = 10$  kg and d = 5 m, find: (i) An expression for F represented as  $\frac{km_1 m_2}{d^2}$ . Give the answer as a value for k.

(ii) The distance, d for F = 30 N,  $m_1 = 7.5$  kg and  $m_2 = 4$  kg. Represent solution as  $a\sqrt{2}$ . Give the answer as a value for a.

## Problem 71

The data shows the marks obtained by students in a biology test

52	56	25	56	68	73	66	64	56	48
20	39	9	50	46	54	54	40	50	96
36	44	18	97	65	21	60	44	54	32
92	49	37	94	72	88	89	35	59	34
15	88	53	16	84	52	72	46	60	42

A. Construct a frequency distribution table using the class interval 0 - 9,10 - 19,20 - 29...

- B. Draw a cumulative frequency curve for the distribution.
- C. Use the graph to estimate:
- (i) The median, within the margin of  $\pm 1$ .

(ii) The percentage of students who scored at least 66 marks, correct to the nearest whole number.

## Problem 72

Solve the inequality  $\frac{1}{3}x - \frac{1}{4}(x+2) \ge 3x - 1\frac{1}{3}$ . Represent solution as  $x \ge \frac{a}{b}$ . Write answer as a, b.

## Problem 73

A. Copy and complete the table of values for  $y = 2\cos x + 3\sin x$  for  $0^{\circ} \le x \le 360^{\circ}$ . Give the answer as a sequence of missing numbers.



B. Using a scale of 2 cm to 60° on the x-axis and 2 cm to 1 unit in the y-axis, draw the graph of  $y = 2\cos x + 3\sin x$  for  $0^{\circ} \le x \le 360^{\circ}$ .

C. Using the graph:

(i) Solve  $2\cos x + 3\sin x = -1$ .

(ii) Find, within the margin of  $\pm 0.1$ , the value of y when  $x = 342^{\circ}$ .

## Problem 74

A woman bought 130 kg of tomatoes for 52,000.00. She sold half of the tomatoes at a profit of 30%. The rest of the tomatoes began to go bad, she then reduced the selling price per kg by 12%. Calculate: (i) The new selling price per kg.

(ii) The percentage profit on the entire sales if she threw away 5 kg of bad tomatoes.

## Problem 75

(a) The third and sixth terms of a geometric progression are  $\frac{1}{4}$  and  $\frac{1}{32}$  respectively. Find: (i) The first term and the common ratio. Give the answers as decimal numbers.

(ii) The seventh term. Represent solution as  $2^h$ . Give the answer as the value of h.

(b) Given that 2 and -3 are the roots of the equation  $ax^2+bx+c=0$ , find the values of a, b and c.

## Problem 76

(a) Given that  $\sin y = \frac{8}{17}$ , find the value of  $\frac{\tan y}{1+2\tan y}$ . The angle is in the first quadrant. Represent solution as  $\frac{a}{b}$ . Give the answer in the form of a, b. (b) An amount of N300,000.00 was shared among Otobo, Ada and Adeola. Otobo received N60,000.00, Ada received  $\frac{5}{12}$  of the remainder, while the rest went to Adeola. In what ratio was the money shared? Simplify solution ratio e: f: g to the maximal extent and give the answer in the form of e, f, g.

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