



R SQUARED — ESAT PREPARATION
MOCK PAPER 1 – MATHEMATICS MODULE 1

Time: 40 minutes • 27 questions • 1 mark each • no penalty for incorrect answers

1. Find the complete set of solutions to $|3x - 5| > 7$.

A $x < -\frac{2}{3}$

B $x > 4$

C $-\frac{2}{3} < x < 4$

D $x < -\frac{2}{3}$ or $x > 4$

E $x < 4$

F $x > -\frac{2}{3}$

2. Evaluate $\frac{(3\sqrt{5} + \sqrt{5})^2 - (3\sqrt{5} - \sqrt{5})^2}{(3\sqrt{5} + \sqrt{5})^2 + (3\sqrt{5} - \sqrt{5})^2}$

A 1

B 3

C $\frac{3}{5}$

D $\frac{3}{7}$

E 33

F 9

3. A group of drivers, consisting of 180 women and 270 men, was asked if they passed their driving test at the first attempt. Altogether 150 of the group said they passed at the first attempt. Of the women, 120 said they did not pass at the first attempt. How many of the men said they passed at the first attempt?

A 10
B 24
C 33
D 60
E 90
F 133
G 157

4. Which one of the following is a simplification of $(\sqrt{5} - 2)^2$?

A $1 - 4\sqrt{5}$
B $9 - 4\sqrt{5}$
C 1
D 9
E $9 + 4\sqrt{5}$
F $5 - 4\sqrt{5} + 4$

5. Solve fully the inequality $x^2 - 4x \geq 21$

A $x \leq -3$
B $x \geq 7$
C $x \leq -3$ or $x \geq 7$
D $-3 \leq x \leq 7$
E $x \leq 7$
F $x \geq -3$

6. A cuboid has sides of length x cm, $2x$ cm, and $(x + 2)$ cm. The volume, in cm^3 , of the cuboid is numerically equal to twice the total surface area, in cm^2 , of the cuboid. What is the value of x ?

A 10

B $6 + 2\sqrt{2}$

C 5

D $4 + 2\sqrt{7}$

E $\frac{5}{2}$

F $\frac{3 + 2\sqrt{2}}{2}$

7. The ratio of $P : Q$ is $3 : 4$ and the ratio of $Q : R$ is $5 : 6$. Which one of the following gives the ratio $P : R$ in its simplest form?

A $5 : 8$

B $8 : 5$

C $3 : 8$

D $9 : 10$

E $15 : 24$

F $1 : 2$

8. The equation gives y in terms of x : $y = 5 \left(\frac{x-1}{2} \right)^2 - 3$. Which one of the following is a rearrangement for x in terms of y ?

A $x = 1 \pm 2\sqrt{\frac{y+3}{5}}$

B $x = 1 \pm 2\sqrt{\frac{y-3}{5}}$

C $x = 1 \pm \frac{1}{2}\sqrt{5(y+3)}$

D $x = -1 \pm 2\sqrt{\frac{y+3}{5}}$

E $x = 1 \pm 5\sqrt{\frac{y+3}{2}}$

F $x = 1 \pm 2\sqrt{5(y+3)}$

9. The line joining the points with coordinates $(p, p-1)$ and $(1-p, 2p)$ is parallel to the line with equation $3x + 5y + 2 = 0$. What is the value of p ?

A -1

B $-\frac{1}{8}$

C $\frac{1}{9}$

D $\frac{3}{5}$

E 8

F $\frac{5}{3}$

G $-\frac{3}{5}$

10. The mean age of the 25 members of a chess club is exactly 24. The mean age increases by exactly 3 years when 5 new members join. What is the mean age of the five new members?

A 27 years
B 30 years
C 36 years
D 40 years
E 42 years
F 45 years

11. A fruit stall sells apples costing $\pounds x$ each, and pears costing $\pounds y$ each. Sam bought 3 apples and 4 pears, and the total cost of these was $\pounds P$. Lesley bought 5 apples and 2 pears, and the total cost of these was $\pounds Q$. Which of the following is an expression for the cost, in pounds (£), of a pear?

A $\frac{5P - 3Q}{14}$
B $\frac{3Q - 5P}{14}$
C $\frac{5P - 3Q}{7}$
D $\frac{2Q - 3P}{7}$
E $\frac{3P - 5Q}{14}$
F $\frac{5P + 3Q}{14}$

12. A rectangle $PQRS$ is drawn inside a circle, with its vertices on the circumference of the circle. The ratio of the length of PQ to the length of QR is $3 : 1$. The area of the rectangle $PQRS$ is 108 cm^2 . What is the radius, in cm, of the circle?

- A 6
- B $3\sqrt{10}$
- C $3\sqrt{2}$
- D $2\sqrt{15}$
- E $4\sqrt{6}$
- F 12
- G $12\sqrt{2}$
- H $8\sqrt{15}$

13. A piece of medical equipment is bought for £20 000. Its value depreciates by 15% every year. By how much has its value reduced after 2 years?

- A £3000
- B £4500
- C £5100
- D £5550
- E £6000
- F £6800

14. P is directly proportional to Q squared. When P is 2, Q is 4. Q is inversely proportional to R . When Q is 2, R is 5. What is P in terms of R ?

A $\frac{25}{2R^2}$

B $\frac{25}{R^2}$

C $\frac{5}{2R^2}$

D $\frac{50}{R^2}$

E $\frac{25}{4R^2}$

F $\frac{10}{R^2}$

15. The expected number of bottles of water sold in a day at a sports ground is directly proportional to the square of the average outside temperature, in degrees Celsius, for that day. On a day when the average outside temperature is 10°C , 100 bottles of water, the expected number, are sold. On a warmer day, when the average outside temperature is $T^\circ\text{C}$, 300 bottles of water are sold, which is 44 bottles more than the expected number for that day. What is the value of T ?

A 7.5

B 450

C 16

D 32

E 1148

F 56.25

16. The point A is 6 km due North of the point B . The bearing of the point C from A is 150° and the bearing of C from B is 060° . Find the distance BC .
- A 2 km
- B 3 km
- C $3\sqrt{3}$ km
- D 6 km
- E $6\sqrt{3}$ km
- F 9 km
17. Two sequences are defined by the following rules: in sequence S the n th term is $5n + 2$; in sequence T the n th term is $90 - 2n^2$. What is the smallest value of n for which the n th term of sequence S is greater than the n th term of sequence T ?
- A 4
- B 5
- C 6
- D 7
- E 8
- F 9
18. At a cinema, drinks are sold in regular and large sizes. The cups for these are mathematically similar. The ratio of the heights of the cups and the ratio of the depths of the drinks are both $3 : 4$. The volume of drink in a regular size cup is 243 cm^3 . What is the volume, in cm^3 , of drink in a large size cup?
- A 384
- B 400
- C 500
- D 576
- E 625
- F 640

19. The quantities x and y are positive. x is inversely proportional to the square root of y . When $x = 10$, $y = 4$. What is the value of y when $x = 5$?

A 1
B 2
C 8
D 16
E 20
F 25

20. Which one of the following is a simplification of $\frac{(3x-2)^2 - (2x+1)^2}{x-3}$?

A $5x - 1$
B $5x + 1$
C $x - 1$
D $x + 1$
E $-5x + 1$
F $-x - 1$

21. The mean of n numbers is p . The mean of two of these numbers is q . The mean of the remaining numbers is 8. Which of the following is a correct expression for n in terms of p and q ?

A $\frac{2(q-8)}{p-8}$
B $\frac{2(q+8)}{p-8}$
C $\frac{2(q-8)}{p+8}$
D $\frac{q-8}{2(p-8)}$
E $\frac{2(q-8)}{8-p}$
F $\frac{8-2q}{p-8}$

- 22.** In a trapezium $PQRS$, the parallel sides are PQ and RS . $PQ = (x - 4)$ cm, $RS = (x + 4)$ cm, and the vertical height $QR = x$ cm. The area of the trapezium is 169 cm^2 . What is the length of RS ?
- A** 9 cm
- B** 13 cm
- C** 15 cm
- D** 17 cm
- E** 20 cm
- F** 22 cm
- 23.** The parallelogram $OPQR$, labelled clockwise, is in the first quadrant ($x \geq 0, y \geq 0$) with O at the origin. The point R has coordinates $(a, 0)$ and the point Q has coordinates $(2a, a + 3)$. The area of $OPQR$ is 10 square units. What are the coordinates of point P ?
- A** (2, 5)
- B** (1, 3)
- C** (3, 4)
- D** (4, 2)
- E** (5, 2)
- F** (2, 3)
- 24.** The straight lines $x + y = 12$, $y = 4x - 18$, $x = 0$ enclose a region with area K square units. What is the value of K ?
- A** 45
- B** 60
- C** 75
- D** 90
- E** 105
- F** 120

25. Make b the subject of the formula: $a = \frac{2b^2 + 1}{b^2 - 2}$

A $b = \pm \sqrt{\frac{2a + 1}{a - 2}}$

B $b = \pm \sqrt{\frac{2a - 1}{a + 2}}$

C $b = \pm \sqrt{\frac{a + 1}{2a - 2}}$

D $b = \pm \sqrt{\frac{2a + 2}{a - 1}}$

E $b = \pm \sqrt{\frac{a - 2}{2a + 1}}$

F $b = \pm \sqrt{\frac{2a - 2}{a + 1}}$

26. What is the value of x that makes the following expression correct? $2x^3 + 5x^2 - 3x = 9$

A -2.25

B -1.75

C -1.5

D -0.75

E -0.25

- 27.** A scale model of a cylindrical pillar is to be made. The full-sized pillar has a volume of $18\pi \text{ m}^3$. The model will use a length scale of 1 : 50. The model is to be a solid cylinder made of a plastic which has a density of $\frac{5}{6} \text{ g cm}^{-3}$. What is the mass of the model in grams?

A $\frac{9}{640}\pi$

B $\frac{1}{40}\pi$

C 40π

D 72π

E 120π

F $10\,000\pi$

G $225\,000\pi$

H $400\,000\pi$