Warm up questions

Question 1.   2015 Paper 1 Q3

Let $f(x) = -x^2 + 12x - 27,\ x \in \mathbb{R}$.

(a) (i)   Complete Table 1 below.

Table 1							
x	3	4	5	6	7	8	9
$f(x)$	0	5			8		

Question 2.   Solve for x:

$$\frac{x+7}{3} + \frac{2}{x} = 4$$

Question 3.   Express $\sqrt{48} - \sqrt{12} + \sqrt{27}$ in the form $a\sqrt{b}$

Question 4.   Simplify:
$(b + 1)^3 - (b - 1)^3$

-b Formula $\left(\dfrac{-b \pm \sqrt{b^2 - 4ac}}{2a}\right)$

Question 5.   Solve for x: $10x^2 + 6x - 52 = 0$

Question 6.   2011 Paper 1 Q1

Solve the equation $x^2 - 2\sqrt{3}x - 9 = 0$, giving your answers in the form $a\sqrt{3}$, where $a \in \mathbb{Q}$.

Question 7.   2015 Paper 1 Q2 (25 marks)

Solve the equation $x^3 - 3x^2 - 9x + 11 = 0$.
Write any irrational solution in the form $a + b\sqrt{c}$, where $a, b, c \in \mathbb{Z}$.

Inequalities

Question 8.   2021 Paper 1 Q2(a)
(a) Given that $x = -3$ is a solution to $|x+p| = 5$, find the two values of p, where $p \in \mathbb{Z}$.

Question 9.   Solve the following inequality and graph the solution, x ∈ R:
$|3x+4| \le |x+2|$

Question 10. 2018 Paper 1 Q1 (10 marks)

Solve the inequality $\dfrac{2x-3}{x+2} \ge 3$, where $x \in \mathbb{R}$ and $x \ne -2$.

Simultaneous Equations

Question 11. 2012 Paper 1 Q1

Solve the simultaneous equations:

$$a^2 - ab + b^2 = 3$$
$$a + 2b + 1 = 0$$

Question 12. 2022 Paper 1 Q2 b (ii)

The areas of three regions K, L, and N give the following three equations:

$4a + 3b + 3c = 807$
$28a + 9b + 3c = 879$
$76a + 15b + 3c = 663$

Solve these equations to find the values of a, b, and c.

Logs

Question 13. Solve $log_x 8 = 3$

Question 14. Solve $32^{x-1} = 28$ for x and give your answer to 2 decimal places

Question 15. 2016 P1 Q4 (10 marks):

Given $\log_a 2 = p$ and $\log_a 3 = q$, where $a > 0$, write each of the following in terms of p and q:

(i) $\log_a \frac{8}{3}$

(ii) $\log_a \frac{9a^2}{16}$.

Question 16. 2014 P1 Q2

Given that $p = \log_c x$, express $\log_c \sqrt{x} + \log_c (cx)$ in terms of p.

General Questions

Question 17.   2023 P1 Q1

(a) Find the two values of $m \in \mathbb{R}$ for which $|5+3m| = 11$.

(b) For the real numbers h, j, and k:

$$\frac{1}{h} = \frac{k}{j+k}$$

Express k in terms of h and j.

(c) $x^2 - px + 1$ is a factor of $x^3 - 2x - 3r$, where $p, r \in \mathbb{R}$ and $p < 0$. Find the value of p and the value of r.

Question 18.   2023 P1 Q6

(a) f and g are two functions of $x \in \mathbb{R}$, where:

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

(i) Find the two values of x for which $f(x) = g(x)$.

Question 19.   2020 P1 Q1

(a) $f(x) = x^2 + 5x + p$ where $x \in \mathbb{R}$, $-3 \leq p \leq 8$, and $p \in \mathbb{Z}$.

(i) Find the value of p for which $x + 3$ is a factor of $f(x)$.

(ii) Find the value of p for which $f(x)$ has roots which differ by 3.

(iii) Find the two values of p for which the graph of $f(x)$ will not cross the x-axis.

(b) Find the range of values of x for which $|2x + 5| - 1 \leq 0$, where $x \in \mathbb{R}$.

Question 20. Q3 2021 Paper 1

    (a) The diagram shows a cuboid with dimensions x, y and z cm. The areas, in cm², of three of its faces are also shown. Find the volume of the cuboid in the form $a\sqrt{b}$ cm³, where a, $b \in \mathbb{N}$.
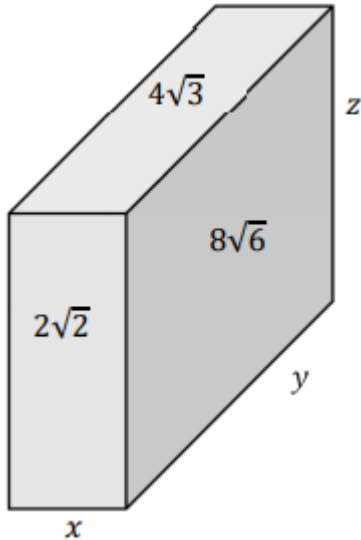
    (b)
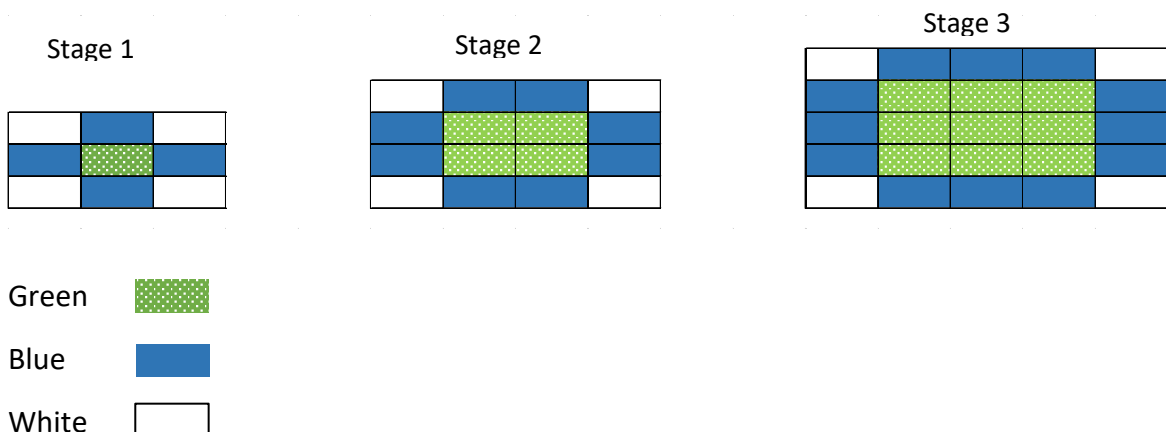
        (i) Given that $f(x) = 3x^2 + 8x - 35$, where $x \in \mathbb{R}$, find the two roots of $f(x) = 0$.

        (ii) Hence or otherwise, solve the equation $3^{2m+1} = 35 - 8(3^m)$, where $m \in \mathbb{R}$. Give your answer in the form $m = \log_3 p - q$, where $p, q \in \mathbb{N}$.

Question 21.

Mary is interested in having the following tile pattern for her kitchen floor.

Green

Blue

White

    (i)   Write an expression for the total number of tiles in the xth stage of the pattern.

    (ii) If there are 324 tiles in total in a pattern, how many green tiles are there?

    (iii) Mary's kitchen area measures 6·76 m². The side of each square tile is 20 cm long. Find the number of each colour of tile that needs to be ordered.

Question 22. 2016 Q8 part b, 25 marks

The heptathlon is an Olympic competition. It consists of seven events including the 200 m race and the javelin. The scoring system uses formulas to calculate a score for each event. The table below shows the formulas for two of the events and the values of constants used in these formulas, where x is the time taken (in seconds) or distance achieved (in metres) by the competitor and y is the number of points scored in the event.

Event	x	Formula	a	b	c
200 m race	Time (s)	$y = a(b-x)^c$	4·99087	42·5	1·81
Javelin	Distance (m)	$y = a(x-b)^c$	15·9803	3·8	1·04

1) In the heptathlon, Jessica ran 200 m in 23·8 s and threw the javelin 58·2 m. Use the formulas in the table to find the number of points she scored in each of these events, correct to the nearest point.

2) The world record distance for the javelin, in the heptathlon, would merit a score of 1295 points. Find the world record distance for the javelin, in the heptathlon, correct to two decimal places.

3) The formula used to calculate the points for the 800 m race, in the heptathlon, is the same formula used for the 200 m race but with different constants. Jessica ran the 800 m race in 2 minutes and 1·84 seconds which merited 1087 points. If $a = 0·11193$ and $b = 254$ for the 800 m race, find the value of c for this event, correct to two decimal places.

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