



### 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

**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.** 2013 Paper 1 Q2

(a) Find the set of all real values of  $x$  for which  $2x^2 + x - 15 \geq 0$ .

**Question 9.** Solve the following inequality and graph the solution,  $x \in \mathbb{R}$ :

$$|3x+4| \leq |x+2|$$

**Question 10.** 2018 Paper 1 Q1 (10 marks)

Solve the inequality  $\frac{2x-3}{x+2} \geq 3$ , where  $x \in \mathbb{R}$  and  $x \neq -2$ .



**Question 11.** 2012 Paper 1 Q1

Find the set of all real values of  $x$  for which  $\frac{2x-5}{x-3} \leq \frac{5}{2}$ .

## Simultaneous Equations

**Question 12.** 2012 Paper 1 Q1

Solve the simultaneous equations:

$$\begin{aligned}a^2 - ab + b^2 &= 3 \\ a + 2b + 1 &= 0\end{aligned}$$

**Question 13.** 2018 Paper 1 Q1 (15 marks)

Solve the simultaneous equations.

$$\begin{aligned}2x + 3y - z &= -4 \\ 3x + 2y + 2z &= 14 \\ x - 3z &= -13\end{aligned}$$

## Logs

**Question 14.** Solve  $\log_x 8 = 3$

**Question 15.** Solve  $32^{x-1} = 28$  for  $x$  and give your answer to 2 decimal places

**Question 16.** 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 17.** 2014 P1 Q2

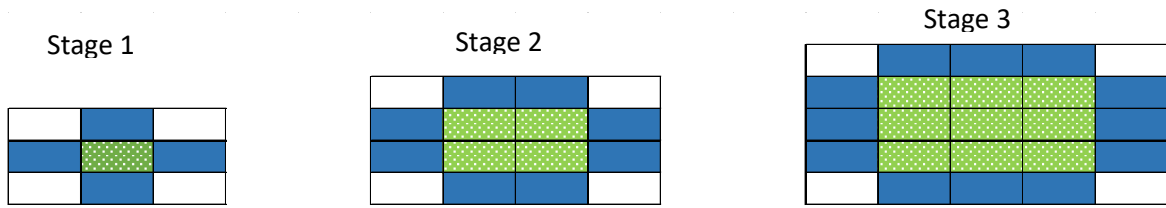
Given that  $p = \log_c x$ , express  $\log_c \sqrt{x} + \log_c(cx)$  in terms of  $p$ .

Solutions: <https://web.actuaries.ie/students/maths-tutorials-higher-level-leaving-certificate-20192020> or google 'actuaries maths tutorials'



### Additional Questions

**Question 18.** Mary is interested in having the following tile pattern for her kitchen floor.



- 1) Write an expression for the total number of tiles in the  $x^{\text{th}}$  stage of the pattern.
- 2) If there are 324 tiles in total in a pattern, how many green tiles are there?
- 3) Mary's kitchen area measures  $6.76 \text{ m}^2$ . The side of each square tile is 20 cm long. Find the number of each colour of tile that needs to be ordered.

**Question 19. 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.