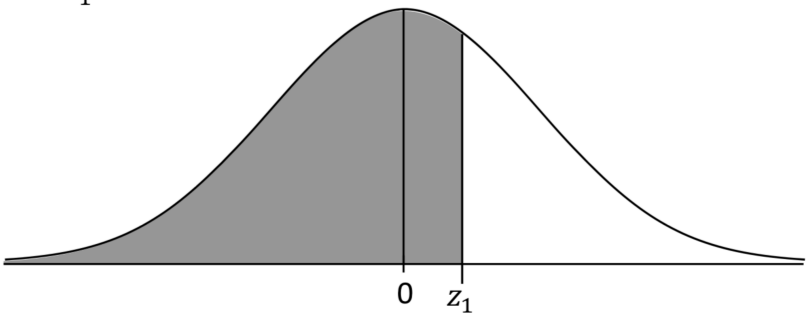
Question 2 **(25 marks)**

(a) The diagram shows the standard normal curve. The shaded area represents 67% of the data. Find the value of z_1.



(b) The percentage results in a Maths exam for a class had a mean mark of 70 with a standard deviation of 15. The percentage results in an English exam for the same class had a mean mark of 72 with a standard deviation of 10. The results in both exams were normally distributed.

(i) Mary got 65 in Maths and 68 in English. In which exam did Mary do better relative to the other students in the class? Justify your answer.

(ii) In English the top 15% of students were awarded an A grade.
Find the least whole number mark that merited the award of an A grade in English.

(iii) Using the empirical rule, or otherwise, estimate the percentage of students in the class who scored between 52 and 82 in the English test.

Q2	Model Solution – 25 Marks	Marking Notes
(a)	$P(z < z_1) = 0{\cdot}67$ $z = 0{\cdot}44$	**Scale 5B (0, 2, 5)** *Partial Credit:* $P(z < z_1) = 0{\cdot}67$
(b) **(i)**	Mary Maths $\frac{65-70}{15} = -\frac{1}{3}$ Mary English $\frac{68-72}{10} = -\frac{2}{5}$ $-\frac{1}{3} > -\frac{2}{5}$ Mary did better in Maths Justification: $-\frac{1}{3} > -\frac{2}{5}$	**Scale 10C (0, 3, 7, 10)** *Low Partial Credit:* Relevant formula with some correct substitution $\frac{65-70}{15}$ or $\frac{68-72}{10}$. *High Partial Credit:* $\frac{65-70}{15}$ and $\frac{68-72}{10}$
(b) **(ii)**	$P(z > z_1) = 0{\cdot}15$ $z = \frac{x-72}{10} = 1{\cdot}04$ $x = 82{\cdot}4\%$ $x = 83$	**Scale 5C (0, 2, 4, 5)** *Low Partial Credit:* $0{\cdot}15$ $1{\cdot}04$ Relevant formula with some correct substitution *High Partial Credit:* Relevant equation in x

(b) (iii)	82 is 1 st. dev. above mean $\Rightarrow \approx \frac{68}{2}\%$ above 52 is 2 st. dev. below mean $\Rightarrow \approx \frac{95}{2}\%$ below $34+ 47{\cdot}5=81{\cdot}5\%$ **Or** From tables: 82 is 1 deviation off mean $\Rightarrow \frac{0{\cdot}6826}{2} = 0{\cdot}3413$ 52 is 2 dev. off mean $\Rightarrow \frac{0{\cdot}9544}{2} = 0{\cdot}4772$ $0{\cdot}3413 + 0{\cdot}4772 = 0{\cdot}8185 = 81{\cdot}85\%$ **Or** $z = \frac{52-72}{10} = -2$ $z = \frac{82-72}{10} = 1$ $P(-2 < z < 1)$ $P(z < 1) - [1 - P(z < 2)]$ $0{\cdot}8413 - [1 - 0{\cdot}9772]$ $= 0{\cdot}8185$ $=81{\cdot}85\%$	**Scale 5C (0, 2, 4, 5)** *Low Partial Credit:* Evidence of relevant linking of deviation and mean. $\frac{68}{2}$ or $\frac{95}{2}$ $\frac{52-72}{10}$ or $\frac{82-72}{10}$ $\frac{0{\cdot}6826}{2}$ or $\frac{0{\cdot}9544}{2}$ *High Partial Credit:* $\frac{68}{2}$ and $\frac{95}{2}$ $\frac{52-72}{10}$ and $\frac{82-72}{10}$ $\frac{0{\cdot}6826}{2}$ and $\frac{0{\cdot}9544}{2}$