

Normal Distribution Answers

1)

$$X \sim N(7, 0.5^2)$$

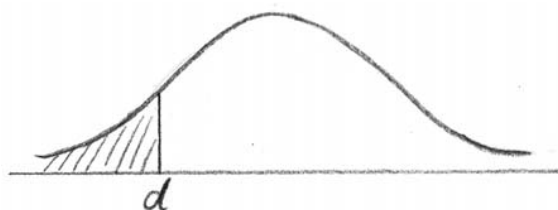
(a) (i) $z = 2$ (M1)
 $P(X < 8) = P(Z < 2) = 0.977$ A1 N2

(ii) evidence of appropriate approach (M1)
 e.g. symmetry, $z = -2$
 $P(6 < X < 8) = 0.954$ (tables 0.955) A1 N2

Note: Award **M1A1(AP)** if candidates refer to 2 standard deviations from the mean, leading to 0.95.

[4 marks]

(b) (i)



A1A1 N2

Note: Award **A1** for d to the left of the mean, **A1** for area to the left of d shaded.

(ii) $z = -1.645$ (A1)

$$\frac{d - 7}{0.5} = -1.645$$

(M1)

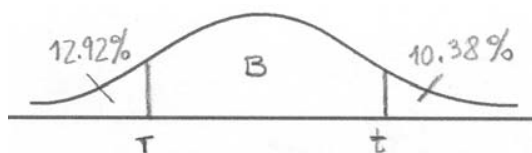
$$d = 6.18$$

A1 N3

[5 marks]

2)

(a)



A1A1 N2

Notes: Award **A1** for three regions, (may be shown by lines or shading)
A1 for clear labelling of two regions (may be shown by percentages or categories).
 r and t need not be labelled, but if they are, they may be interchanged.

(b) **METHOD 1**

$$P(X < r) = 0.1292$$

(A1)

$$r = 6.56$$

A1 N2

$$1 - 0.1038 = 0.8962 \text{ (may be seen later)}$$

A1

$$P(X < t) = 0.8962$$

(A1)

$$t = 7.16$$

A1 N2

METHOD 2

finding z -values $-1.130\dots, 1.260\dots$ A1A1

evidence of setting up one standardised equation (M1)

e.g. $\frac{r - 6.84}{0.25} = -1.13\dots, t = 1.260 \times 0.25 + 6.84$

$$r = 6.56, t = 7.16$$

A1A1 N2N2

[7 marks]

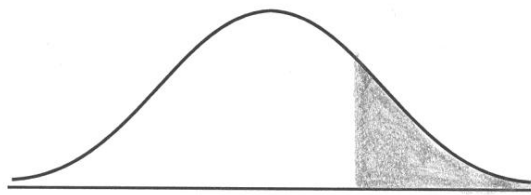
Normal Distribution Answers

3)

- (a) evidence of attempt to find $P(X \leq 475)$ (M1)
e.g. $P(Z \leq 1.25)$
 $P(X \leq 475) = 0.894$ AI N2
- (b) evidence of using the complement (M1)
e.g. $0.73, 1 - p$
- $z = 0.6128$ (AI)
 setting up equation (M1)
e.g. $\frac{a - 450}{20} = 0.6128$
 $a = 462$ AI N3
- [6 marks]**

4)

(a)



A1A1 N2

Note: Award **A1** for vertical line to right of mean, **A1** for shading to right of **their** vertical line.

- (b) evidence of recognizing symmetry (M1)
e.g. 105 is one standard deviation above the mean so d is one standard deviation below the mean, shading the corresponding part,
 $105 - 100 = 100 - d$
- $d = 95$ AI N2
- (c) evidence of using complement (M1)
e.g. $1 - 0.32, 1 - p$
- $P(d < X < 105) = 0.68$ AI N2
- [6 marks]**

Normal Distribution Answers

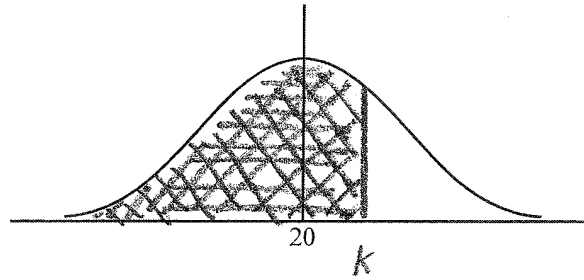
5) (a) $\sigma = 3$ (A1)

evidence of attempt to find $P(X \leq 24.5)$ (M1)

e.g. $z = 1.5, \frac{24.5 - 20}{3}$

$P(X \leq 24.5) = 0.933$ A1 N3
[3 marks]

(b) (i)



A1A1 N2

Note: Award *A1* with shading that clearly extends to right of the mean,
A1 for any correct label, either k , area or their value of k .

(ii) $z = 1.03(64338)$ (A1)

attempt to set up an equation (M1)

e.g. $\frac{k - 20}{3} = 1.0364, \frac{k - 20}{3} = 0.85$

$k = 23.1$ A1 N3
[5 marks]

Total [8 marks]

Normal Distribution Answers

- 6)
- (a) symmetry of normal curve (M1)
e.g. $P(X < 25) = 0.5$
- $P(X > 27) = 0.2$ A1 N2
[2 marks]
- (b) **METHOD 1**
- finding standardized value (A1)
e.g. $\frac{27 - 25}{\sigma}$
- evidence of complement (M1)
e.g. $1 - p$, $P(X < 27)$, 0.8
- finding z-score (A1)
e.g. $z = 0.84\dots$
- attempt to set up equation involving the standardized value M1
e.g. $0.84 = \frac{27 - 25}{\sigma}$, $0.84 = \frac{X - \mu}{\sigma}$
- $\sigma = 2.38$ A1 N3
[5 marks]
- METHOD 2**
- set up using normal CDF function and probability (M1)
e.g. $P(25 < X < 27) = 0.3$, $P(X < 27) = 0.8$
- correct equation A2
e.g. $P(25 < X < 27) = 0.3$, $P(X > 27) = 0.2$
- attempt to solve the equation using GDC (M1)
e.g. solver, graph, trial and error (more than two trials must be shown)
- $\sigma = 2.38$ A1 N3
[5 marks]
- Total [7 marks]**