SL - Binomial Questions Answers

0 min
0 marks

1. (a) evidence of attempt to find $P(X \leq 475)$ (M1)
e.g. $P(Z \leq 1.25)$
$P(X \leq 475) = 0.894$ A1 N2

(b) evidence of using the complement (M1)
e.g. 0.73, $1 - p$
$z = 0.6128$ (A1)
setting up equation (M1)
e.g. $\frac{a-450}{20} = 0.6128$
$a = 462$ A1 N3

[6]

2. $A \sim N(46, 10^2)$ $B \sim N(\mu, 12^2)$

(a) $P(A > 60) = 0.0808$ A2 N2

(b) correct approach (A1)
e.g. $P\left(Z < \frac{60-\mu}{12}\right) = 0.85$, sketch
$\frac{60-\mu}{12} = 1.036...$ (A1)
$\mu = 47.6$ A1 N2

(c) (i) route A A1 N1

(ii) **METHOD 1**

$P(A < 60) = 1 - 0.0808 = 0.9192$ A1

valid reason R1

e.g. probability of A getting there on time is greater than probability of B

$0.9192 > 0.85$ N2

METHOD 2

$P(B > 60) = 1 - 0.85 = 0.15$ A1

valid reason R1

e.g. probability of A getting there late is less than probability of B

$0.0808 < 0.15$

N2

(d) (i) let X be the number of days when the van arrives before 07:00

$P(X = 5) = (0.85)^5$ (A1)

$= 0.444$ A1 N2

(ii) **METHOD 1**

evidence of adding correct probabilities (M1)

e.g. $P(X \geq 3) = P(X = 3) + P(X = 4) + P(X = 5)$

correct values $0.1382 + 0.3915 + 0.4437$ (A1)

$P(X \geq 3) = 0.973$ A1 N3

METHOD 2

evidence of using the complement (M1)

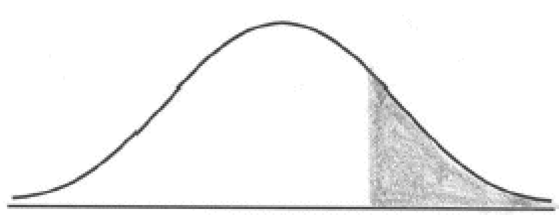
e.g. $P(X \geq 3) = 1 - P(X \leq 2)$, $1 - p$

correct values $1 - 0.02661$ (A1)

$P(X \geq 3) = 0.973$ A1 N3

[13]

3. (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,
$105 - 100 = 100 - d$

$d = 95$ A1 N2

(c) evidence of using complement (M1)
e.g. $1 - 0.32$, $1 - p$

$P(d < X < 105) = 0.68$ A1 N2

[6]

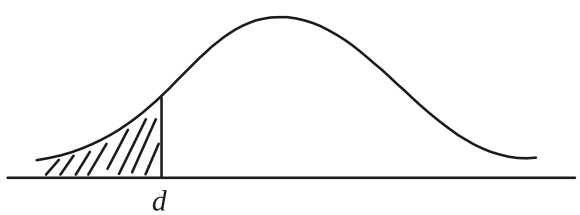
4. $X \sim N(7, 0.5^2)$

(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.*

(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

(c) $Y \sim N(\mu, 0.5^2)$

$P(Y < 5) = 0.2$ (M1)

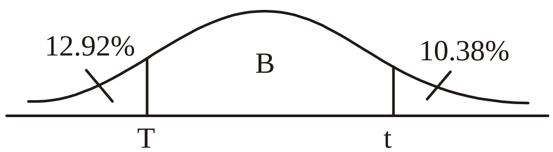
$z = -0.84162...$ A1

$\frac{5-\mu}{0.5} = -0.8416$ (M1)

$\mu = 5.42$ A1 N3

[13]

5. (a)



A1A1 N2

Notes: *Award A1 for three re.g.ions, (may be shown by lines or shading) A1 for clear labelling of two re.g.ions (may be shown by percentages or cate.g.ories).*

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) (may be seen later) A1

$P(X < t) = 0.8962$ (A1)

$t = 7.16$ A1 N2

METHOD 2

finding z-values $-1.130...$, $1.260...$ A1A1

evidence of setting up one standardized equation (M1)

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

$r = 6.56$, $t = 7.16$ A1A1 N2N2

[7]

6. (a) evidence of approach (M1)

e.g. finding 0.84…, using $\frac{23.7-21}{\sigma}$

correct working (A1)

e.g. $0.84... = \frac{23.7-21}{\sigma}$, graph

$\sigma = 3.21$ A1 N2

(b) (i) evidence of attempting to find $P(X < 25.4)$ (M1)

e.g. using $z = 1.37$

$P(X < 25.4) = 0.915$ A1 N2

(ii) evidence of recognizing symmetry (M1)

e.g. $b = 21 – 4.4$, using $z = –1.37$

$b = 16.6$ A1 N2

[7]

7. **METHOD 1**

(a) $\sigma = 10$ (A1)

$1.12 \times 10 = 11.2$ A1

$11.2 + 100$ (M1)

$x = 111.2$ A1 N2

(b) $100 – 11.2$ (M1)

$= 88.8$ A1 N2

[6]

METHOD 2

(a) $\sigma = 10$ (A1)

Evidence of using standardisation formula (M1)

$\frac{x-100}{10} = 1.12$ A1

$x = 111.2$ A1 N2

(b) $\frac{100-x}{10} = 1.12$ A1

$x = 88.8$ A1 N2

[6]

8. (a) Evidence of using the complement *e.g.* $1 - 0.06$ (M1)
$p = 0.94$ A1 N2

(b) For evidence of using symmetry (M1)
Distance from the mean is 7 (A1)
e.g. diagram, D = mean – 7
$D = 10$ A1 N2

(c) $P(17 < H < 24) = 0.5 - 0.06$ (M1)
$= 0.44$ A1

E(trees) $= 200 \times 0.44$ (M1)
$= 88$ A1 N2

[9]

9. $X \sim N(\mu, \sigma^2)$
$P(X > 90) = 0.15$ **and** $P(X < 40) = 0.12$ (M1)
Finding standardized values 1.036, –1.175 A1A1
Setting up the equations $1.036 = \dfrac{90-\mu}{\sigma}, -1.175 = \dfrac{40-\mu}{\sigma}$ (M1)
$\mu = 66.6, \sigma = 22.6$ A1A1 N2N2

[6]

10. (a) $P(H < 153) = 0.705 \Rightarrow z = 0.538(836...)$ (A1)

Standardizing $\dfrac{153-\mu}{5}$ (A1)

Setting up **their** equation $0.5388... = \dfrac{153-\mu}{5}$ M1

$\mu = 150.30\text{K}$

$= 150$ (to 3sf) A1 N3

(b) $Z = \dfrac{153-\mu}{5} = 1.138...$ (accept 1.14 from $\mu = 150.3$, or 1.2 from $\mu = 150$) (A1)

$P(Z > 1.138) = 0.128$ (accept 0.127 from $z = 1.14$, or 0.115 from $z = 1.2$) A1 N2

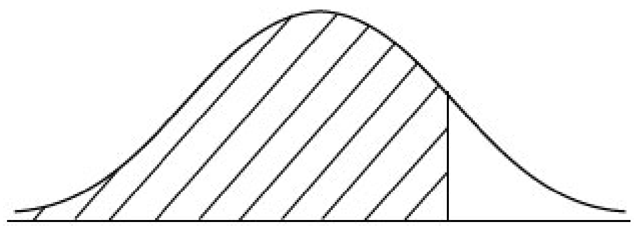
[6]

11. (a) 0.0668 A2 N2

(b) Using the standardized value 1.645 (A1)

$k = 26.1$ kg A1 N2

(c)



A1A1 N2

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

[6]

12. *Note:* *Candidates may be using tables in this question, which leads to a variety of values. Accept reasonable answers that are consistent with working shown.*

$W \sim N(2.5, 0.3^2)$

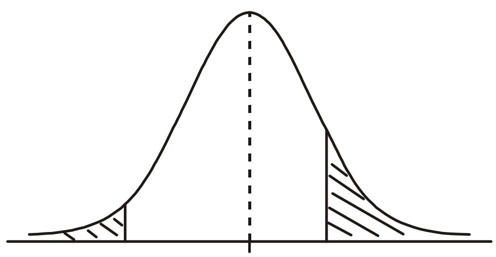
(a) (i) $z = -1.67$ (accept 1.67) (A1)

$P(W < 2) = 0.0478$ (accept answers between 0.0475 and 0.0485) A1 N2

(ii) $z = 1$ (A1)

$P(W > 2.8) = 0.159$ A1 N2

(iii)



A1A1 N2

Note: *Award A1 for a vertical line to left of mean and shading to left, A1 for vertical line to right of mean and shading to right.*

(iv) Evidence of appropriate calculation M1

eg $1 - (0.047790 + 0.15866)$, $0.8413 - 0.0478$

$P = 0.7936$ AG N0

Note: *The final value may vary depending on what level of accuracy is used.*

Accept their value in subsequent parts.

(b) (i) $X \sim B(10, 0.7935...)$

Evidence of calculation — M1

eg $P(X = 10) = (0.7935...)^{10}$

$P(X = 10) = 0.0990$ (3 sf) — A1 N1

(ii) **METHOD 1**

Recognizing $X \sim B(10, 0.7935...)$ (may be seen in (i)) — (M1)

$P(X \leq 6) = 0.1325...$ (or $P(X = 1) + ... + P(X = 6)$) — (A1)

evidence of using the complement — (M1)

eg $P(X \geq 7) = 1 - P(X \leq 6)$, $P(X \geq 7) = 1 - P(X < 7)$

$P(X \geq 7) = 0.867$ — A1 N3

METHOD 2

Recognizing $X \sim B(10, 0.7935...)$ (may be seen in (i)) — (M1)

For adding terms from $P(X = 7)$ to $P(X = 10)$ — (M1)

$P(X \geq 7) = 0.209235 + 0.301604 + 0.257629 + 0.099030$ — (A1)

$= 0.867$ — A1 N3

[13]

13. (a) $z = \dfrac{180 - 160}{20} = 1$ — (A1)

$\phi(1) = 0.8413$ — (A1)

P(height > 180) = $1 - 0.8413$

$= 0.159$ — A1 N3

(b) $z = -1.1800$ — (A1)

Setting up equation $-1.18 = \dfrac{d - 160}{20}$ — (M1)

$d = 136$ — A1 N3

[6]

14.

***Notes**: Accept any suitable notation, as long as thecandidate's intentions are clear.*

The following symbols will be used in the markscheme.

Girls' height G ~ N(155, 10^2), boys' height B N(160, 12^2)
Height H, Female F, Male M.

(a) $P(G > 170) = 1 - P(G < 170)$ (A1)

$P(G > 170) = P\left(Z < \frac{170-155}{10}\right)$ (A1)

$P(G > 170) = 1 - \Phi(1.5) = 1 - 0.9332$

$= 0.0668$ A1 N3

(b) $z = -1.2816$ (A1)

Correct calculation (*eg* $x = 155 + -1.282 \times 10$) (A1)

$x = 142$ A1 N3

(c) Calculating one variable (A1)

eg $P(B < r) = 0.95$, $z = 1.6449$

$r = 160 + 1.645(12) = 179.74$

$= 180$ A1 N2

Any valid calculation for the second variable, including use of symmetry (A1)

eg $P(B < q) = 0.05$, $z = -1.6449$

$q = 160 - 1.645(12) = 140.26$

$= 140$ A1 N2

***Note**: Symbols are not required in parts (d) and (e).*

(d) $P(M \cap (B > 170)) = 0.4 \times 0.2020$, $P(F \cap (G > 170)) = 0.6 \times 0.0668$ (A1)(A1)

$P(H > 170) = 0.0808 + 0.04008$ A1

$= 0.12088 = 0.121$ (3 sf) A1 N2

(e) $P(F \mid H > 170) = \dfrac{P(F \cap (H > 170))}{P(H > 170)}$ (M1)

$= \dfrac{0.60 \times 0.0668}{0.121}$ $\left(= \dfrac{0.0401}{0.121} \text{ or } \dfrac{0.04008}{0.1208} \right)$ A1

$= 0.332$ A1 N1

[17]

15. $X \sim N(\mu, \sigma^2)$, $P(X < 3) = 0.2$, $P(X > 8) = 0.1$

$P(X < 8) = 0.9$ (M1)

Attempt to set up equations (M1)

$\dfrac{3-\mu}{\sigma} = -0.8416$, $\dfrac{8-\mu}{\sigma} = 1.282$ A1A1

$3 - \mu = -0.8416\sigma$

$8 - \mu = 1.282\sigma$

$5 = 2.1236\sigma$

$\sigma = 2.35$, $\mu = 4.99$ A1A1 N4

[6]

16. $X \sim N(\mu, \sigma^2)$, $P(X > 90) = 0.15$ **and** $P(X < 40) = 0.12$ (M1)

Finding standardized values 1.036, –1.175 A1A1

Setting up the equations $1.036 = \dfrac{90-\mu}{\sigma}$, $-1.175 = \dfrac{40-\mu}{\sigma}$ (M1)

$\mu = 66.6$, $\sigma = 22.6$ A1A1

[6]

17. (i) $P(X > 3\,200) = P(Z > 0.4)$ (M1)

$= 1 - 0.6554 = 34.5\,\%$ $(= 0.345)$ (A1) (N2)

(ii) $P(2\,300 < X < 3\,300) = P(-1.4 < Z < 0.6)$ (M1)

$= 0.4192 + 0.2257$

$= 0.645$ (A1)

$P(\text{both}) = (0.645)^2 = 0.416$ (A1) (N2)

(iii) $0.7422 = \mathrm{P}(Z < 0.65)$ (A1)

$$\frac{d - 3\,000}{500} = 0.65$$ (A1)

$d = \$\,3\,325$ $(= \$\,3\,330$ to 3 s.f.$)$ (Accept \$3325.07) (A1) (N3)

[8]

18. (a) $z = \frac{185 - 170}{20} = 0.75$ (M1)(A1)

P(Z < 0.75) = 0.773 (A1) (N3)

(b) $z = -0.47$ (may be implied) (A1)

$$-0.47 = \frac{d - 170}{20}$$ (M1)

$d = 161$ (A1) (N3)

[6]

19. (a) (i) $a = -1$ (A1)

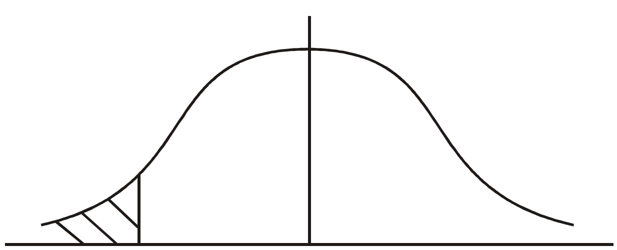
$b = 0.5$ (A1)

(ii) (a) 0.841 (A2)

(b) $0.6915 - 0.1587$ (or $0.8413 - 0.3085$) (M1)

$= 0.533$ (3 sf) (A1)(N2) 6

(b) (i) Sketch of normal curve (A1)(A1)



(ii) $c = 0.647$ (A2) 4

[10]

20. $X \sim N(80, 8^2)$

(a) $P(X < 72) = P(Z < -1)$ (M1)

$= 1 - 0.8413$

$= 0.159$ (A1)

OR

$P(X < 72) = 0.159$ (G2) 2

(b) (i) $P(72 < X < 90) = P(-1 < Z < 1.25)$ (M1)

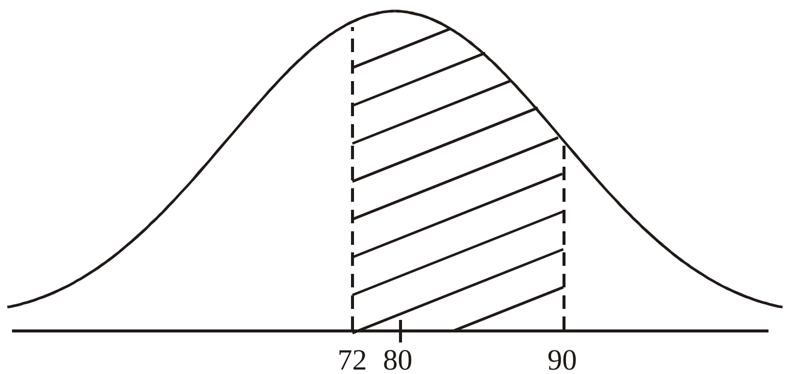
$= 0.3413 + 0.3944$ (A1)

$= 0.736$ (A1)

OR

$P(72 < X < 90) = 0.736$ (G3)

(ii)



(A1)(A1) 5

Note: *Award (A1) for a normal curve and (A1) for the shaded area, which should not be symmetrical.*

(c) 4% fail in less than x months

$\Rightarrow x = 80 - 8 \times \Phi^{-1}(0.96)$ (M1)

$= 80 - 8 \times 1.751$ (A1)

$= 66.0$ months (A1)

OR

$x = 66.0$ months (G3) 3

[10]

21. (a) $P(M \geq 350) = 1 - P(M < 350) = 1 - P\left(Z < \frac{350 - 310}{30}\right)$ (M1)

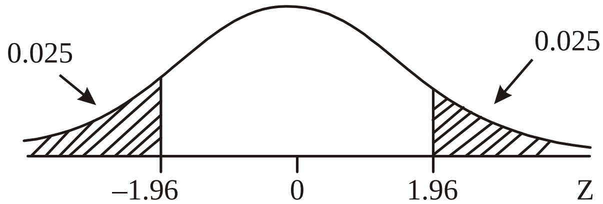
$= 1 - P(Z < 1.333) = 1 - 0.9088$

$= 0.0912$ (accept 0.0910 to 0.0920) (A1)

OR

$P(M \geq 350) = 0.0912$ (G2)

(b)



$P(Z < 1.96) = 1 – 0.025 = 0.975$ (A1)

$1.96 (30) = 58.8$ (M1)

$310 – 58.8 < M < 310 + 58.8 \Rightarrow a = 251, b = 369$ (A1)

OR

$251 < M < 369$ (G3)

Note: *Award (G1) if only one of the end points is correct.*

[5]

22. (a) (These answers may be obtained from a calculator or by finding z in each case and the corresponding area.)

$M \sim N (750, 625)$

(i) $P (M < 740 \text{ g}) = 0.345$ (G2)

OR

$z = –0.4 \quad P(z < –0.4) = 0.345$ (A1)(A1)

(ii) $P (M > 780 \text{ g}) = 0.115$ (G2)

OR

$z = 1.2 \quad P(z > 1.2) = 1 – 0.885 = 0.115$ (A1)(A1)

(iii) $P(740 < M < 780) = 0.540$ (G1)

OR

$1 – (0.345 + 0.115) = 0.540$ (A1) 5

(b) Independent events

Therefore, P (both < 740) $= 0.345^2$ (M1)

$= 0.119$ (A1) 2

(c) 70% have mass < 763 g (G1)

Therefore, 70% have mass of at least 750 – 13

$x = 737$ g (A1) 2

[9]

23. ***Note:*** *Where accuracy is not specified, accept answers with greater than 3 sf accuracy, provided they are correct as far as 3 sf*

(a) $z = \dfrac{197 - 187.5}{9.5} = 1.00$ (M1)

$\text{P}(Z > 1) = 1 - \Phi(1) = 1 - 0.8413 = 0.1587$

$= 0.159$ (3 sf) (A1)

$= 15.9\%$ (A1)

OR

$\text{P}(H > 197) = 0.159$ (G2)

$= 15.9\%$ (A1) 3

(b) Finding the 99^{th} percentile

$\Phi(a) = 0.99 \Rightarrow a = 2.327$ (accept 2.33) (A1)

$\Rightarrow$ 99% of heights under $187.5 + 2.327(9.5) = 209.6065$ (M1)

$= 210$ (3 sf) (A1)

OR

99% of heights under 209.6 = 210 cm (3 sf) (G3)

Height of standard doorway = 210 + 17 = 227 cm (A1) 4

[7]

24. (a) Let X be the random variable for the IQ.

$X \sim \text{N}(100, 225)$

$\text{P}(90 < X < 125) = \text{P}(-0.67 < Z < 1.67)$ (M1)

$= 0.701$

70.1 percent of the population (accept 70 percent). (A1)

OR

$\text{P}(90 < X < 125) = 70.1\%$ (G2) 2

(b) $\text{P}(X \geq 125) = 0.0475$ (or 0.0478) (M1)

P(both persons having IQ ≥ 125) $= (0.0475)^2$ (or $(0.0478)^2$) (M1)

$= 0.00226$ (or 0.00228) (A1) 3

(c) Null hypothesis (H_0): mean IQ of people with disorder is 100 (M1)
Alternative hypothesis (H_1): mean IQ of people with disorder is less than 100 (M1)

$$P(\bar{X} < 95.2) = P\left(Z < \left(\frac{95.2 - 100}{\frac{15}{\sqrt{25}}}\right)\right) = P(Z < -1.6) = 1 - 0.9452$$

$= 0.0548$ (A1)

The probability that the sample mean is 95.2 and the null hypothesis true is 0.0548 > 0.05. Hence the evidence is not sufficient. (R1) 4

[9]

25. (a) $Z = \dfrac{25 - 25.7}{0.50} = -1.4$ (M1)

$P(Z < -1.4) = 1 - P(Z < 1.4)$
$= 1 - 0.9192$
$= 0.0808$ (A1)

OR

$P(W < 25) = 0.0808$ (G2) 2

(b) $P(Z < -a) = 0.025 \Rightarrow P(Z < a) = 0.975$
$\Rightarrow a = 1.960$ (A1)

$\dfrac{25 - \mu}{0.50} = -1.96 \Rightarrow \mu = 25 + 1.96\,(0.50)$ (M1)

$= 25 + 0.98 = 25.98$ (A1)
$= 26.0$ (3 sf) (AG)

OR

$\dfrac{25.0 - 26.0}{0.50} = -2.00$ (M1)

$P(Z < -2.00) = 1 - P(Z < 2.00)$
$= 1 - 0.9772 = 0.0228$ (A1)
≈ 0.025 (A1)

OR

$\mu = 25.98$ (G2)
$\Rightarrow$ mean $= 26.0$ (3 sf) (A1)(AG) 3

(c) Clearly, by symmetry $\mu = 25.5$ (A1)

$Z = \frac{25.0 - 25.5}{\sigma} = -1.96 \Rightarrow 0.5 = 1.96\sigma$ (M1)

$\Rightarrow \sigma = 0.255$ kg (A1) 3

(d) On average, $\frac{\text{cement saving}}{\text{bag}} = 0.5$ kg (A1)

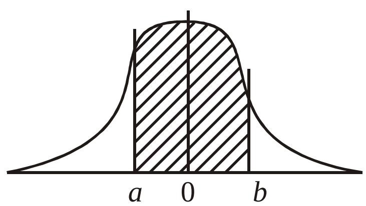
$\frac{\text{cost saving}}{\text{bag}} = 0.5(0.80) = \$0.40$ (M1)

To save \$5000 takes $\frac{5000}{0.40} = 12500$ bags (A1) 3

[11]

26. (a) Let X be the lifespan in hours

$X \sim N(57, 4.4^2)$



(i) $a = -0.455$ (3 sf) (A1)

$b = 0.682$ (3 sf) (A1)

(ii) (a) $P(X > 55) = P(Z > -0.455)$

$= 0.675$ (A1)

(b) $P(55 \le X \le 60) = P\left(\frac{2}{4.4} \le Z \le \frac{3}{4.4}\right)$

$\approx P(0.455 \le Z \le 0.682)$

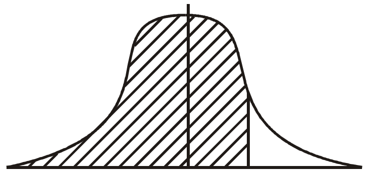
$\approx 0.6754 + 0.752 - 1$ (A1)

$= 0.428$ (3sf) (A1)

OR

$P(55 \le X \le 60) = 0.428$ (3 sf) (G2) 5

(b) 90% have died $\Rightarrow$ shaded area = 0.9 (M1)



(A1)

Hence $t = 57 + (4.4 \times 1.282)$ (M1)

$= 57 + 5.64$ (A1)

$= 62.6$ hours (A1)

OR $t = 62.6$ hours (G3) 5

[10]

27. (a) ***Note:*** *Candidates using tables may get slightly different answers, especially if they do not interpolate. Accept these answers.*

$P(\text{speed} > 50) = 0.3 = 1 - \Phi\left(\frac{50-\mu}{10}\right)$ (A1)

Hence, $\frac{50-\mu}{10} = \Phi^{-1}(0.7)$ (M1)

$\mu = 50 - 10\Phi^{-1}(0.7)$ (M1)

$= 44.75599 \ldots\ldots = 44.8$ km/h (3 sf) (accept 44.7) (AG) 3

(b) H_1: "the mean speed has been reduced by the campaign". (A1) 1

(c) One-tailed; because H_1 involves only "<". (A2) 2

(d) For a one-tailed test at 5% level, critical region is

$Z < \mu_m - 1.64\sigma_m$ *(accept $-1.65\sigma_m$)* (M1)

Now, $\mu_m = \mu = 44.75\ldots$; $\sigma_m = \frac{\sigma}{\sqrt{n}} = \frac{10}{\sqrt{25}} = 2$ *(allow ft)* (A1)

So test statistic is $44.75\ldots - 1.64 \times 2 = 41.47$ (A1)

Now $41.3 < 41.47$ so reject H_0, yes. (A1) 4

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28. (a) Area $A = 0.1$ (A1) 1

(b) **EITHER** Since $p\ (X \geq 12) = p\ (X \leq 8)$, (M1)

then 8 and 12 are symmetrically disposed around the mean. (M1)(R1)

Thus mean = $\dfrac{8+12}{2}$ (M1)

$= 10$ (A1)

Notes: *If a candidate says simply "by symmetry $\mu = 10$" with no further explanation award [3 marks] (M1, A1, R1). As a full explanation is requested award an additional (A1) for saying since $p(X < 8) = p(X > 12)$ and another (A1) for saying that the normal curve is symmetric.*

OR $p\ (X \geq 12) = 0.1 \Rightarrow p\left(Z \geq \dfrac{12-\mu}{\sigma}\right) = 0.1$ (M1)

$\Rightarrow p\left(Z \leq \dfrac{12-\mu}{\sigma}\right) = 0.9$

$p\ (X \leq 8) = 0.1 \Rightarrow p\left(Z \leq \dfrac{8-\mu}{\sigma}\right) = 0.1$

$\Rightarrow p\left(Z \leq \dfrac{\mu-8}{\sigma}\right) = 0.9$ (A1)

So $\dfrac{12-\mu}{\sigma} = \dfrac{\mu-8}{\sigma}$ (M1)

$\Rightarrow 12 - \mu = \mu - 8$ (M1)

$\Rightarrow \mu = 10$ (A1) 5

(c) $\Phi\left(\dfrac{12-10}{\sigma}\right) = 0.9$ (A1)(M1)(A1)

Note: *Award (A1) for* $\left(\dfrac{12-10}{\sigma}\right)$, *(M1) for standardizing, and (A1) for 0.9.*

$\Rightarrow \dfrac{2}{\sigma} = 1.282$ (or 1.28) (A1)

$\sigma = \dfrac{2}{1.282}\left(\text{or } \dfrac{2}{1.28}\right)$ (A1)

$= 1.56$ (3 sf) (AG) 5

Note: *Working backwards from $\sigma = 1.56$ to show it leads the given data should receive a maximum of [3 marks] if done correctly.*

(d) $p\ (X \le 11) = p\left(Z \le \frac{11-10}{1.561}\right)$ (or 1.56) (M1)(A1)

Note: *Award (M1) for standardizing and (A1) for* $\left(\frac{11-10}{1.561}\right)$.

$= p\ (Z \le 0.6407)$ (or 0.641 or 0.64) (A1)

$= \Phi(0.6407)$ (M1)

$= 0.739$ (3 sf) (A1) 5

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