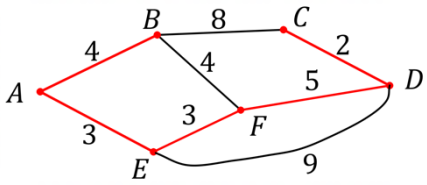
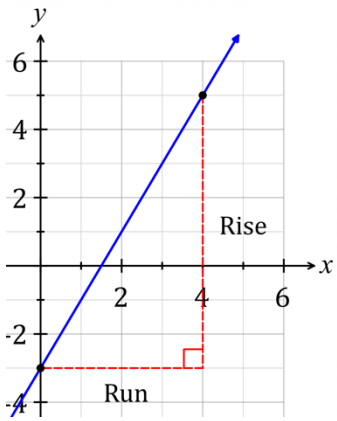
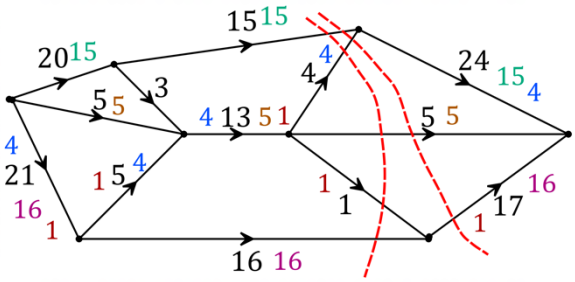
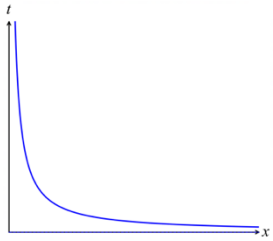
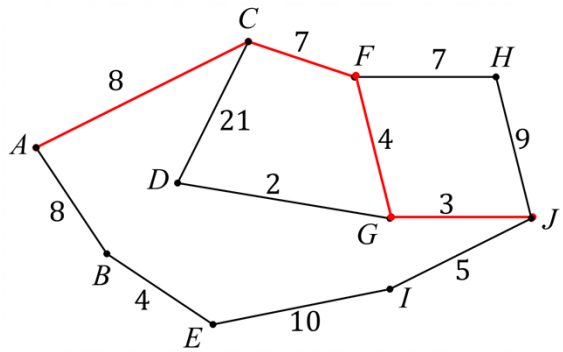
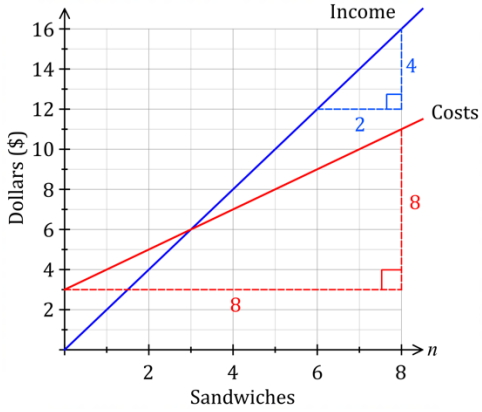
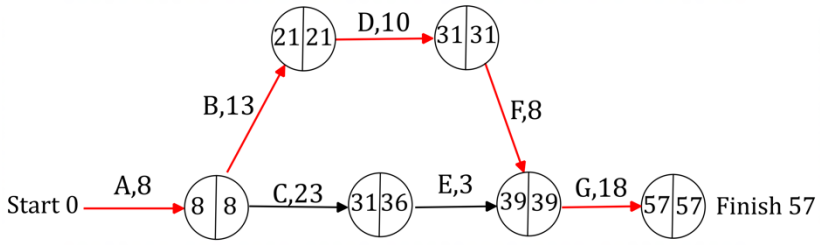
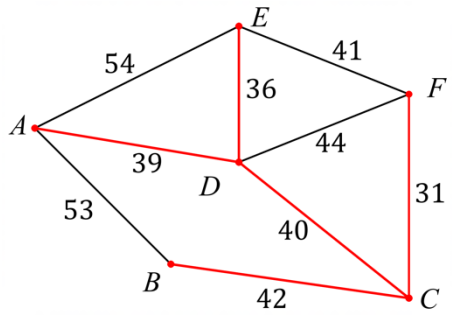
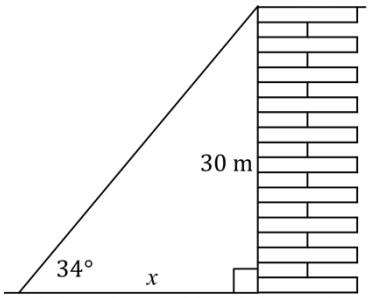
ACE Examination Paper 2
Year 12 Mathematics Standard 2 Yearly Examination
Worked solutions and marking guidelines

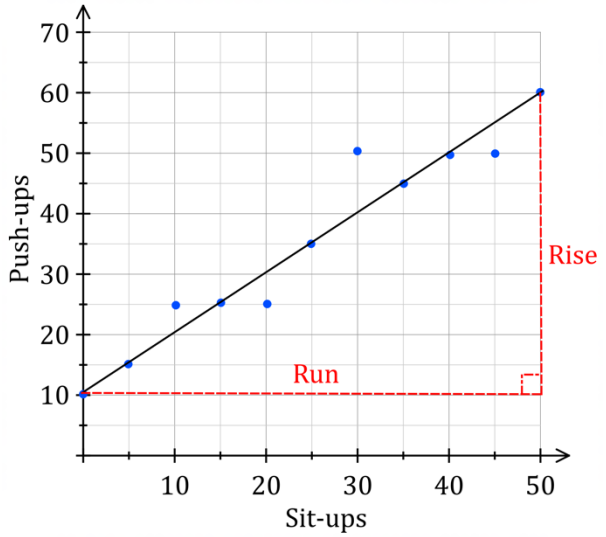
Section I		
	Solution	**Criteria**
1.	Electricity $= 1.5 \times 4$ Cost $= 6 \times 0.2572$ $= 6$ kWh $\approx \$1.54$	1 Mark: C
2.	$V_{n+1} = V_n(1 + r) + D$ 1st: $1000 \times 1.05 + 100 = 1150$ 2nd: $1150 \times 1.05 + 100 = 1307.50$ 3rd: $1307.50 \times 1.05 + 100 = 1472.875 \approx \$1472.88$	1 Mark: B
3.	 Minimal spanning tree is shown above, last vertex was C.	1 Mark: B
4.	Correlation between –0.5 and –0.74. Moderate negative.	1 Mark: A
5.	Intersection value is 7.88 (8.25% and 25 years) Repayment $= 7.88 \times 320$ $= \$2521.60$	1 Mark: C
6.	7.25 L $= 100$ km 0.725 L $= 10$ km 0.725×31 L $= 310$ km 22.475 L $= 310$ km	1 Mark: C
7.	$\cos\angle BAC = \dfrac{80^2 + 95^2 - 120^2}{2 \times 80 \times 95}$ $= 0.06743\ldots$ $\angle BAC \approx 86°$	1 Mark: D
8.	$z = \dfrac{x - \bar{x}}{s}$ $= \dfrac{81 - 67}{7}$ $= 2$	1 Mark: D
9.	$A = 600 \times 1.1^t$ $= 600 \times 1.1^0$ $= \$600$	1 Mark: A

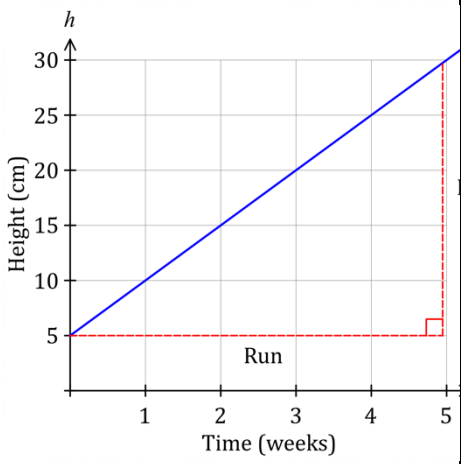
	Solution	Criteria
10.	$m = \dfrac{\text{Rise}}{\text{Run}}$ $= \dfrac{8}{4} = 2$ y-intercept : -3 $\therefore$ Equation of the line $y = mx + c$ $y = 2x - 3$ 	1 Mark: A
11.	 Maximum flow equals the value of the minimum cut. Maximum flow $= 15 + 4 + 5 + 17$ $= 41$	1 Mark: B
12.	Cost for each person is \$50 $(c = 50n + 135)$. Cost decrease $= 5 \times 50$ $= \$250$	1 Mark: C
13.	Reciprocal function. 	1 Mark: D
14.	Mathematics z-score $z = \dfrac{x - \bar{x}}{s} = \dfrac{80 - 64}{8} = 2$ Equivalent score in the English test with the same z-score. $z = \dfrac{x - \bar{x}}{s}$ $2 = \dfrac{x - 60}{11}$ $x = (2 \times 11) + 60 = 82$	1 Mark: D
15.	$FV = PV(1 + r)^2$ $= 1700 \times (1 + 0.0006)^{15}$ $= 1715.3644\ldots$ Interest charged $= 1715.3644\ldots - 1700$ $\approx \$15.36$	1 Mark: B

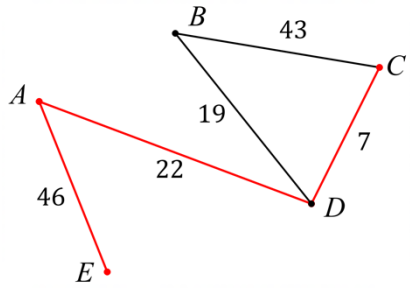
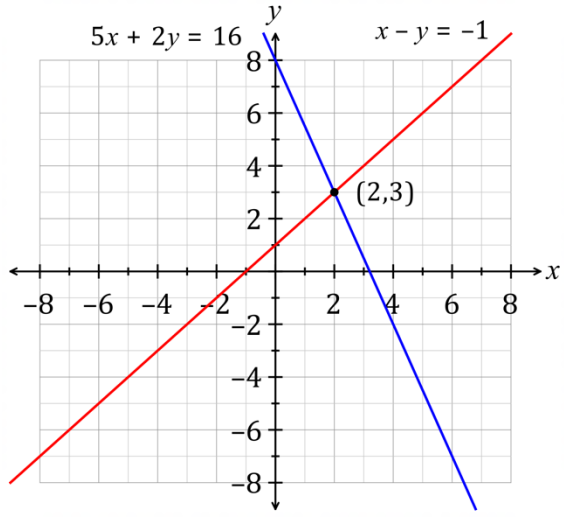
Section II		
	Solution	**Criteria**
16(a)	Actual distance $= 2.5 \times 400\,000$ cm $= 1\,000\,000$ cm $= 10$ km	1 mark: Correct answer.
16(b)	Drawing length $= \dfrac{60 \times 100 \times 1000}{4\,000\,000}$ cm $= 15$ cm	1 mark: Correct answer.
17	$z = \dfrac{x - \bar{x}}{s}$ $\quad z = \dfrac{x - \bar{x}}{s}$ $= \dfrac{62 - 74}{6}$ $\quad = \dfrac{86 - 74}{6}$ $= -2$ $\quad = 2$ $\therefore$ 95% of scores have a z-score between –2 and 2	2 marks: Correct answer. 1 mark: Finds the z-score for 62 or 86.
18(a)	$\angle HFG + 43° + 33° = 180°$ $\angle HFG = 104°$ (angle sum of a triangle is 180˚)	1 mark: Correct answer.
18(b)	$\dfrac{g}{\sin \angle FGH} = \dfrac{f}{\sin \angle HFG}$ $\dfrac{g}{\sin 33°} = \dfrac{55}{\sin 104°}$ $g = \dfrac{55 \times \sin 33°}{\sin 104°}$ $= 30.8721\ldots$ ≈ 30.9 cm	2 marks: Correct answer. 1 mark: Uses the sine rule with at least one correct value.
19(a)	Vertices with an odd degree are C, F, G and J.	1 mark: Correct answer.
19(b)	 Shortest path is A–C–F–G–J Length $= 8 + 7 + 4 + 3$ $= 22$	2 marks: Correct answer. 1 mark: Finds the shortest path or shows some understanding.

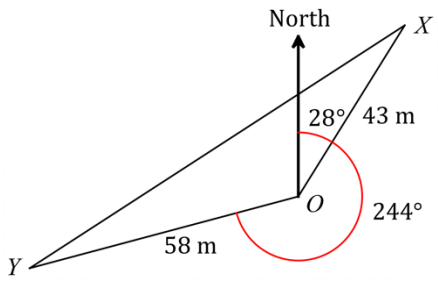
20(a)	$m = \frac{\text{Rise}}{\text{Run}} = \frac{4}{2} = 2$ y-intercept : 0 $y = mx + c$ $I = 2n$		1 mark: Correct answer.
20(b)	$m = \frac{\text{Rise}}{\text{Run}} = \frac{8}{8} = 1$ y-intercept : 3 $y = mx + c$ $C = n + 3$		1 mark: Correct answer.
20(c)	Profit $= (2 \times 7) - (7 + 3)$ $= \$4$		1 mark: Correct answer.
20(d)	n = 3 (Point of intersection on the graph)		1 mark: Correct answer.
21(a)			3 Marks: Correct answer. 2 Marks: Completes the EST or LST 1 Mark: Draws a network diagram with some correct edges .
21(b)	Critical path is A–B–D–F–G Minimum completion time is 57 minutes.		2 Marks: Correct answer. 1 Mark: Finds the critical path or minimum completion time.
22(a)	Daily interest rate $= \frac{15.7\%}{365}$ $= 0.043013\ldots$ $\approx 0.0430\%$		1 mark: Correct answer.
22(b)	12 days (30,31,1,2,3,4,5,6,7,8,9,10) Interest $= 1240 \times 0.043013\ldots\% \times 12$ $= 6.4004\ldots$ $\approx \$6.40$ Total paid $= 1240 + 6.40$ $= \$1246.40$ $\therefore$ Total amount paid for the entertainment unit is \$1246.40		2 Marks: Correct answer. 1 Mark: Calculates the interest.
23(a)	Intersection value is 4.2124 (6% and 5 years) $PV = 4.2124 \times 9000$ $= \$37\,911.60$		1 mark: Correct answer.
23(b)	Intersection value is 3.9020 (1% and 4 years) $PV = 3.9020 \times 6000$ $= \$23\,412$		1 mark: Correct answer.

23(c)	Intersection value is 2.5771 (8% and 3 years) Let the value of the annuity be x $43\,230 = x \times 2.5771$ $x = \dfrac{43\,230}{2.5771}$ $= \$16\,774.6692\ldots \approx \$16\,775$ $\therefore$ Value of the annuity is \$16 775 per year.	1 mark: Correct answer.
24(a)		2 marks: Correct answer. 1 mark: Shows some understanding.
24(b)	Length $= 39 + 36 + 40 + 42 + 31$ $= 188$ km $\therefore$ Minimum length of pipes is 188 km.	1 mark: Correct answer.
25	$c = \bar{y} - m\bar{x}$ $= 65 - 0.6 \times 50$ $= 35$ $\therefore y$-intercept is 35.	1 mark: Correct answer.
26(a)	$z = \dfrac{x - \bar{x}}{s}$ $= \dfrac{85 - 55}{15}$ $= 2$	1 mark: Correct answer.
26(b)	Sally has a z-score of 2 which is two standard deviations above the mean.	1 mark: Correct answer.
26(c)	$z = \dfrac{x - \bar{x}}{s}$ $-1 = \dfrac{x - 55}{10}$ $x = (-1 \times 10) + 55$ $= 45$ $\therefore$ Hospitality mark of 45 has a z-score of –1.	1 mark: Correct answer.
27	$\tan 34° = \dfrac{30}{x}$ $x = \dfrac{30}{\tan 34°}$ $= 44.4768\ldots$ ≈ 44 m  $\therefore$ The car is about 44 metres from the foot of the building.	2 Marks: Correct answer. 1 Mark: Labels the diagram or uses the correct trig ratio.

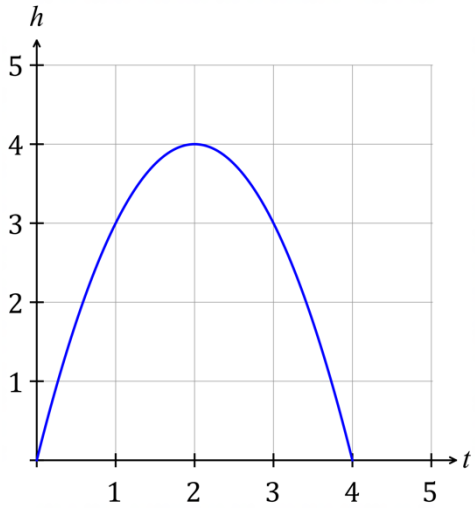
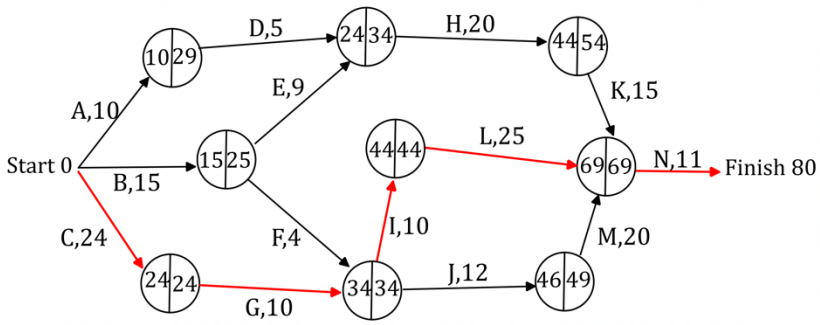
28(a)	 $m = \frac{\text{Rise}}{\text{Run}} = \frac{20}{20} = 1$ ∴ Gradient is 1.	2 marks: Correct answer. 1 mark: Finds the line of best fit or shows some understanding.
28(b)	When s = 36 then p = 46 (from the scatterplot) Alyssa should score 46 on the push-up test.	1 mark: Correct answer.
28(c)	Data: (0,10)(5,15)(10,25)(15,25)(20,25)(25,35) (30,50)(35,45)(40,50)(45,50)(50,60) $r = 0.968450\ldots$ ≈ 0.97	2 marks: Correct answer. 1 mark: Finds a value of r close to 0.9.
29	$\text{Drip rate} = \frac{1.5 \times 1000}{8}$ $= 187.5$ mL/h	1 mark: Correct answer.
30(a)	Intersection value is \$1580.75 (20 years) Total paid $= 1580.75 \times 12 \times 20$ = \$379 380 ∴ Total amount to be repaid is \$379 380	1 mark: Correct answer.
30(b)	Intersection value is \$1364.35 (30 years) Total paid $= 1364.35 \times 12 \times 30$ = \$491 166 Extra paid $= 491\,166 - 379\,380$ = \$111 786 ∴ Extra paid is \$111 786	2 marks: Correct answer. 1 mark: Finds the total paid if the loan is taken out for 30 years.
31(a)	95% of scores have a z-score between 2 and –2. 56 is a z-score of 2 and 44 is a z-score of –2. $\text{Mean} = \frac{44 + 56}{2} = 50$ ∴ Mean number of hours is 50.	2 Marks: Correct answer. 1 Mark: Uses the z–score of 2 and –2.

31(b)	There are 4 standard deviations between 44 and 56. Standard deviation $= \dfrac{56-44}{4}$ $= 3$ h	1 mark: Correct answer.
32(a)	Initial height is 5 cm.	1 mark: Correct answer.
32(b)	$m = \dfrac{\text{Rise}}{\text{Run}}$ $= \dfrac{25}{5}$ $= 5$ Gradient is 5.  	1 mark: Correct answer.
32(c)	y-intercept : 5 $\therefore$ Equation of the line $y = mx + c$ $h = 5t + 5$	1 mark: Correct answer.
33	$t = \dfrac{k}{s}$ $\qquad$ $t = \dfrac{260}{s}$ $4 = \dfrac{k}{65}$ $\qquad$ $= \dfrac{260}{80}$ $k = 260$ $\qquad$ $= 3.25$ h or 3 h 15 min	2 Marks: Correct answer. 1 Mark: Finds the value of k or shows some understanding
34(a)	Intersection value is 24.297 (2% and 20 years) $FV = 24.297 \times 6000$ $= \$145\,782$	1 mark: Correct answer.
34(b)	Intersection value is 4.2465 (4% and 4 years) $FV = 4.2465 \times 5400$ $= \$22\,931.10$	1 mark: Correct answer.
35	Dimensions of the extension are 8 m by 7 m. $A = lb = 8 \times 7 = 56$ m^2 Cost $= 56 \times 570$ $= \$31\,920$ $\therefore$ Cost of the extension is \$31 920	2 Marks: Correct answer. 1 Mark: Finds the area of the extension.

36(a)	Weight edge: $AD = 22$, $AE = 46$, $BC = 43$, $BD = 19$, $CD = 7$ 	2 marks: Correct answer. 1 mark: Draws the vertices with at least one correct edge.
36(b)	Shortest path from E to C. E–A–D–C	1 mark: Correct answer.
36(c)	Longest path $= 46 + 22 + 19 + 43$ $= 130$ km $\therefore$ Distance of the longest path is 130 km.	1 mark: Correct answer.
37(a)	$S = V_0(1 - r)^n$ $= 120\,000 \times (1 - 0.16)^3$ $= \$71\,124.48$ $\therefore$ Salvage value of the car is \$71 124.48	1 mark: Correct answer.
37(b)	Loss $= 120\,000 - 71\,124.48$ $= \$48\,875.52$ Percentage loss $= \dfrac{48\,875.52}{120\,000} \times 100$ $= 40.7296$ $\approx 41\%$	2 Marks: Correct answer. 1 Mark: Finds the loss.
38	$5x + 2y = 16$ $2y = -5x + 16$ $y = -\dfrac{5}{2}x + 8$ Gradient of –2.5 y-intercept 8 $x - y = -1$ $y = x + 1$ Gradient of 1 y-intercept 1 	3 Marks: Correct answer. 2 Marks: Draws both lines correctly or reads a point of intersection from one correct graph. 1 mark: Draws one of the lines correctly or shows some understanding.

39(a)	$\angle XOY$ $= (360° - 244°) + 28°$ $= 144°$ 	1 mark: Correct answer.
39(b)	$A = \frac{1}{2}ab\sin C$ $= \frac{1}{2} \times 43 \times 58 \times \sin 144°$ $= 732.9682\ldots$ $\approx 733\ \text{m}^2$	1 mark: Correct answer.
39(c)	$XY^2 = 43^2 + 58^2 - 2 \times 43 \times 58 \times \cos 144°$ $XY = 96.1684\ldots\ldots$ $\approx 96.2\ \text{m}$	1 mark: Correct answer.
40	$z = \frac{x - \bar{x}}{s}$ $= \frac{70 - 56}{14}$ $= 1$ $\therefore$ 84% of scores have a z-score less than1. Percentage $= 50\% + \frac{68\%}{2}$ $= 84\%$	2 Marks: Correct answer. 1 mark: Calculates the z-score.
41(a)	\$371 640.00	1 mark: Correct answer.
41(b)	$FV = 371\,640 \times \left(1 + \frac{0.08}{12}\right)$ $= \$374\,117.60$ Amount owed $= 374\,117.60 - 2840$ $= \$371\,277.60$ $\therefore$ Amount owed at the end of second month is \$371 277.60	1 mark: Correct answer.
41(c)	$FV = 371\,277.60 \times \left(1 + \frac{0.08}{12}\right)$ $= \$373\,752.784$ Amount owed $= 373\,752.78 - 2840$ $= \$370\,912.78$ $\therefore$ Amount owed at the end of third month is \$370 912.78	1 mark: Correct answer.

<table>
<tr><td>42</td><td>MHR $= 220 - \text{AGE (years)}$
$= 220 - 17.5 = 202.5$
Heart rate $= 0.55 \times 202.5$
$= 111.375$
≈ 111.4 bpm
$\therefore$ Holly's heart rate is 111.4 bmp.</td><td>2 Marks: Correct answer.

1 mark: Finds the MHR.</td></tr>
<tr><td>43(a)</td><td><table><tr><td>t</td><td>0</td><td>1</td><td>2</td><td>3</td><td>4</td></tr><tr><td>h</td><td>0</td><td>3</td><td>4</td><td>3</td><td>0</td></tr></table></td><td>1 mark: Correct answer.</td></tr>
<tr><td>43(b)</td><td> 
</td><td>1 mark: Correct answer.</td></tr>
<tr><td>43(c)</td><td>Maximum height reached is 4 metres.</td><td>1 mark: Correct answer.</td></tr>
<tr><td>43(d)</td><td>Maximum height is reached after 2 seconds.</td><td>1 mark: Correct answer.</td></tr>
<tr><td>44(a)</td><td> 
</td><td>3 Marks: Correct answer.

2 Marks: Finds the EST or LST.

1 Mark: Shows some understanding.</td></tr>
<tr><td>44(b)</td><td>Critical path is C–G–I–L–N
$\therefore$ Minimum completion time is 80 days.</td><td>1 mark: Correct answer.</td></tr>
<tr><td>45</td><td>Length of fence $= 10 + 6 - 1$
$= 15$ m
Cost $= 15 \times 73.50 + 255$
$= \$1357.50$

$\therefore$ Cost of completing the pool enclosure is $1357.50.</td><td>2 Marks: Correct answer.
1 Mark: Finds the length of the fence or shows some understanding.</td></tr>
</table>