# Solutions

## 5.1 Indefinite Integration

1. $\frac{x^4}{4} + \frac{x^3}{3} + \frac{x^2}{2} + x + c$
2. $\frac{5x^4}{4} + x^3 - x^2 - 7x + c$
3. $\frac{-1}{2x^2} + c$
4. $\frac{-3}{x} + c$
5. $\frac{-1}{x} + c$
6. $\frac{2\sqrt{x^3}}{3} + c$
7. $2\sqrt{x} + c$
8. $\frac{3\sqrt[3]{x^4}}{4} + c$
9. $\frac{x^3}{3} + \frac{3x^2}{2} - 2x + c$
10. $\frac{5x^2}{2} + 3x - \frac{3}{x} + c$
11. $\frac{x^5}{5} + \frac{10x^3}{3} + 25x + c$
12. $\frac{2\sqrt{x^5}}{5} - \frac{10\sqrt{x^3}}{3} + c$
13. $f(x) = \frac{x^4}{2} + 7x + 3$
14. $f(x) = x^2 + \frac{2\sqrt{x^3}}{3} + 1$
15. $y = x^2 + 5x + 4$
16. $f(x) = x^3 - 5x^2 + 7x - 3$

## 5.2 Definite Integration

1. 7
2. 120
3. 1.33
4. 0.5
5. 4.83
6. 14.67

## 5.3 Exponential Functions

1. $\frac{e^{5x}}{5} + c$
2. $\frac{e^{2x+1}}{2} + c$
3. 2.46
4. 201.71
5. $\frac{3^x}{\ln 3} + c$
6. 10.82
7. 0.9
8. $3xe^x - 3e^x + c$
9. $2xe^{5x} - \frac{2}{5}e^{5x} + c$
10. $f(x) = 2e^{2x} - 3x + 1$
11. $f(x) = -e^{-3x} + 7x + 3$

## 5.4 Trigonometric Integration

1. $-\frac{\cos 3x}{3} + c$
2. 0
3. $-\frac{\cos 3\theta}{3} - \frac{2\sin 5\theta}{5} + c$
4. $-\frac{\cos 5x}{5} + \frac{\cos 3x}{3} + c$
5. $-\frac{\cos 5x}{10} - \frac{\cos x}{2} + c$
6. 0.49
7. 0.67
8. $3x\sin x + 3\cos x + c$
9. $\frac{2\sin 3x}{3} - 2x\cos 3x + c$

## 5.5 Average Value

1. 21
2. 54.5
3. $\frac{2}{\pi}$
4. 0
5. 6.75
6. 38.17
7. 15 hrs 15 mins
8. 17.44 litres

## 5.6 Rates of Change

1. (a) $s(0) = 0$m and $v(0) = 5$ m/s
   (b) 50 m/s
   (c) 12 m/s$^2$
2. (a) 50 seconds
   (b) 12.25 km
3. (a) $s(0) = 0$ m and $v(0) = 24$ m/s
   (b) $t = 2$ and $t = 4$
   (c) 20 m and 16 m
   (d) 2 seconds
   (e) $6t - 18$ m/s$^2$
   (f) $t = 3$, $s = 18$ m, $v = -3$ m/s
4. (a) -9.8 m/s$^2$
   (b) 4.9 m
   (c) -9.8 m/s
5. (a) 11 m/s
   (b) 2 m/s$^2$
   (c) $s = t^2 + t$ m
   (d) 20 m
6. (a) $v = t^2 - 10t + 25$ m/s
   (b) 4 m/s
   (c) $s = \frac{t^3}{3} - 5t^2 + 25t + 2$

(d) 73.67 m

7. (a) $v = 10 + 9t - 0.45t^2$ m/s
   (b) 55 m/s
   (c) $s = 10t + 4.5t^2 - 0.15t^3$ m
   (d) 11.81 seconds
8. 1102.5 m

## 5.7 Areas

1. 20.83
2. 34.67
3. 4.67
4. 0.38
5. 15.75 + 5.33 = 21.08
6. 1.83+4.5+8.67 = 15
7. 36
8. 10.67
9. 72
10. 2.83
11. 1.33

## 5.8 Exam Questions

1. i. $x = 0 \quad x = 10$
   ii. $\frac{50}{3}$ metres
2. (a) $\frac{5\sin 3x}{3} + c$
   (b) i. $f(x) = x^2 - 2x - 8$
   ii. -8
3. (a) 80 m
   (b) 5 s
   (c) 9.9 s
   (d) 70 s
   (e) 0.2122 m/s
4. (a) (-1,7) and (5,37)
   (b) 36
5. (a) i. 0
   ii. Proof
   (b) i. Sketch
   ii. 36.86 m
   iii. 10.48 sec
   (c) i. Proof
   ii. 3 hrs and 51 mins later