

ANSWERS TO MATHEMATICS EXERCISES

A1

Q1 (a) 5 (b) 2 (c) 24 (d) 21 (e) 9

Q2 (a) $z = \frac{8}{y}$ (b) $z = \frac{6 + 2w}{3}$ (c) $z = 5p$ (d) $z = \frac{bc}{a}$

Q3 (a) (i) $m = \rho V$ (ii) $V = \frac{m}{\rho}$ (b) $r = \frac{C}{2\pi}$ (c) $d^2 = \frac{4A}{\pi}$ (d) $L = \frac{g T^2}{4\pi^2}$

A2

1 (a)(i) $a = \frac{(v - u)}{t}$ (ii) $t = \frac{(v - u)}{a}$ (b) (i) $t = \frac{2s}{(u + v)}$ (ii) $v = \frac{2s}{t} - u$

2. (a) $s = \frac{(v - at + v)t}{2} = \frac{(2v - at)t}{2}$ (b) $s = \frac{2vt - at^2}{2} = vt - \frac{1}{2}at^2$

A3

Q1 (a) 5 (b) 13 (c) 41 , Q2 (a) 12 (b) 4 (c) 40 , Q3 (a) 6 (b) 36 (c) 200

A4

Q1 (a) $y = 2, z = 1$ (b) $y = 4, z = 1$ Q2 (a) $p = 5, q = 2$ (b) $q = 4, p = 3$

Q3 (a) $E = 12 \text{ V}, r = 4\Omega$ (b) $E = 2 \text{ V}, r = 1\Omega$

B1

Q1 (a) 26, 36, 46 m (b) (i)(ii)(iii) 10 m (c) 10 m s^{-1}

Q2 (a) 0.9 m s^{-1} , 0 (b) (i) 0.1 m s^{-1} (ii) 0.5 m s^{-1} (iii) 0.9 m s^{-1} , (c) The speed increases by 0.4 m s^{-1} every 2 seconds which means that the acceleration is constant, equal to 0.2 m s^{-2} .

Q3 (a) 16, 20, 24, 28, 32 m s^{-1} , (b)(i), (ii) (iii) 4 m s^{-1} (c) 4 m s^{-2}

B2

Q1 (a) 67.0 , 44.9 , 30.1 , 20.2 , 13.5 μC (b)(i) $33.0\text{ }\mu\text{C}$, (ii) $14.8\text{ }\mu\text{C}$, (iii) $6.7\text{ }\mu\text{C}$

(c) (i) $33\text{ }\mu\text{A}$, (ii) $6.7\text{ }\mu\text{A}$

Q2 (a) 8.9 V , 6.6 V , 4.9 V , 3.6 V , 2.7 V , (c) $1520\text{ }\mu\text{C}$

Radioactive Decay

Q1 (a) 3.35×10^{20} , 2.25×10^{20} , 1.51×10^{20} , 1.01×10^{20} , 0.68×10^{20} (c) 1.7 s

B3

Q1 $6x^2$, (ii) $20x^4$, (iii) $3x^2 - 2$, (iv) $\frac{4}{3}x^3$

Q2 (i) $2e^x$ (ii) $3e^{3x}$ (iii) $-e^{-x}$ (iv) $-3e^{-x}$ (v) $-2e^{-2x}$

Q3 (i) $5 + 6t$, (ii) $2 - 12t$, (iii) $3 - 15t^2$, (iv) $12t^2 - 4t$

B4

Q1 (i) $2\cos 2t$, (ii) $3\cos t$, (iii) $0.5\cos 0.5t$, (iv) $\cos 0.5t$, (v) $15\cos 5t$

Q2 (i) $-3\sin 3t$, (ii) $-2\sin t$, (iii) $-0.1\sin 0.1t$, (iv) $-12\sin 4t$, (v) $-2\sin 4t$

C1

Q1 (a) (i) 2, (ii) 3, (iii) -2, (iv) 2, (v) $\frac{3}{2}$, (b) (i) 0, (ii) 5, (iii) 6, (iv) 3, (v) -4

Q2 (a) (i) gradient = 4 ; y-intercept = 1 (ii) gradient = 2 , y - intercept = 3

C2

Q1 (a) 8.0×10^{-9} N , 8.9×10^{-10} N , 5.0×10^{-10} N , 3.2×10^{-10} N , 2.2×10^{-10} N

Q2 (a) (i) $2.0 \times 10^4 \text{ s}^{-1}$, (ii) $5.0 \times 10^3 \text{ s}^{-1}$ (b) 2.23 m

Q3 (a) 1.6×10^{15} N , 1.8×10^{14} N , 1.0×10^{14} N , 6.4×10^{13} N , 4.4×10^{13} N

D1

Q1 (a) (i) 2.5 m , (ii) 13.9 m , (b) (i) 2.57 m , (ii) 4.29 m , (c) (i) 3.19 m , (ii) 3.53 m ,

Q3(a) 3.5 m , 6.9 m , (b) 63^0 , 8.9 m , (c) 53^0 , 3.0 m , (d) 9.5 m , 12.4 m ,

(e) 56^0 , 14.4 m , (f) 19.5^0 , 8.5 m , (g) 3.5 m , 2.0 m

D2

Q1 (a) (i) 0.63 , (ii) 0.59 , (b) (i) 1.26 , (ii) 0.95 , (c) 1.57 , 1.0

Q2 (a)(i) 7.0 V , (ii) 11.4 V , (iii) 8.5 V , (iv) -11.4 V , (v) 12.0 V

(b) (i) 1.67 ms , (ii) 2.05 ms (iii) 2.95 ms , (iv) 5.0 ms

D3

Q1 (a) (i) $\frac{\pi}{6}$ (ii) $\frac{\pi}{4}$ (iii) $\frac{\pi}{2}$ (iv) $\frac{3\pi}{4}$ (v) π

(b) (i) 0.105 m (ii) 0.157 m (iii) 0.314 m (iv) 0.471 m (v) 0.628 m

Q2 (a) (i) 0.2 , (ii) 11.5^0 (b) 0.4 , 22.9^0 (c) (i) 1.0 , 57.3^0 (d) (i) 4.0 , (ii) 229^0

Q3 (a) 0.86 m , (b) 0.28 m

E1

Q1 (a) (i) $n = 10^{-9}$ (ii) $\mu = 10^{-6}$ (iii) $m = 10^{-3}$ (iv) $k = 10^3$ (v) $M = 10^6$ (vi) $G = 10^9$

(b) (i) 3.00×10^8 m/s, (ii) 3.1×10^7 s, (iii) 5.90×10^{-7} m

Q2 (a)(i) 5.747×10^3 , 1.483×10^3 (b) (i) 2.8828×10^4 (ii) 4.172×10^3 (c)(i) 1.216×10^{20}

(ii) 1.34×10^{19} , (d) (i) 3.94×10^6 , 3.04×10^6 , (e) (i) 5.61×10^{-6} , (ii) 1.31×10^{-6}

Q3 (a)(i) 6.75×10^6 (ii) 1.70 (b)(i) 2.03×10^6 (ii) 1.34, (c) (i) 3.65×10^{39} (ii) 1.25,

(d) (i) 1.57×10^{12} , (ii) 7.76 (e) (i) 7.44×10^{-12} , (ii) 1.61

E2

Q1 (a)(i) 39 (ii) 1.7×10^{12} (iii) 4.1×10^{42} (iv) 3.0×10^{-9} (v) 1.5×10^{-2}

(b) (i) 1.36 (ii) 15.3 (iii) 3.56×10^3 (iv) 1.95×10^{-1} (v) 7.04×10^{-1}

Q2 (a) (i) 54.0 (ii) 2.14×10^4 (iii) 4.53×10^{21} (iv) 146 (v) 2.92×10^3

(b) (i) 1.46×10^{-2} (ii) 2.59×10^{-5} (iii) 1.16×10^{-23} (iv) 5.09×10^{-3} (v) 2.14×10^{-4}

Q3 (a) (i) 4.82×10^{-7} (ii) 9.13 (iii) 0.123 (iv) 2.97×10^5 (v) 1.10×10^3

(b) (i) 1.58 (ii) 0.16 (iii) 1.84 (iv) 0.737 (v) 1.10

E3

Q1 (a)(i) 1.65 (ii) 2.72 (iii) 4.48 (iv) 2.20×10^4 (v) 2.69×10^{43}

(b) (i) 0.607 (ii) 0.368 (iii) 0.223 (iv) 0.135 (v) 8.21×10^{-2}

Q2 (a) (i) -4.61 (ii) -2.30 (iii) 0 (iv) 2.30 (v) 4.61

(b) (i) -3.51 (ii) -1.20 (iii) 1.10 (iv) 3.40 (v) 5.70

Q3 (a) (i) 0.105 (ii) 1 (iii) 9.49 (b) (i) -0.916 (ii) 1.39 (iii) 3.69

Answers to F1

Q1 (i) 15.0 m , 26.0 m (ii) -34.2 N , 94.0 N

Q2 (a)(i) 8.66 N , 5.00 N (ii) 2.74 N , 7.52 N (b) (i) 16.0 N , 13.9 N (ii) 8.49 N, 6.0 N

Q3 (a)(ii) 17.5 km East, 35 km North

(b)(i) 113 m s^{-1} East , 41.0 m s^{-1} North (ii) 28.8 km East , 76 km North.

Answers to F2

Q1, Q2 (a) 11.7 N at 59° above the x-axis, (b) 14.0 N at 76° above the x-axis

Q3 (a) and (b) (i) 13.1 N at 23.4° to the 9.0 N force , (ii) 6.4 N at 41.7° to the 9.0 N force

Answers to F3

Q1 (b) (i) $6.0 \mathbf{i} + 5.5 \mathbf{j}$ (ii) $-2.0 \mathbf{i} + 0.5 \mathbf{j}$

Q2 (a) $F_1 = 6.0 \mathbf{i}$, $F_2 = 10.0 \mathbf{j}$, $F_1 + F_2 = 6.0 \mathbf{i} + 10.0 \mathbf{j}$, Resultant = 11.7 N

(b) $F_1 = 6.0 \mathbf{i}$, $F_2 = 5.0 \mathbf{i} + 8.7 \mathbf{j}$, $F_1 + F_2 = 11.0 \mathbf{i} + 8.7 \mathbf{j}$, Resultant = 14.0 N

Q3 (a) (i) 5.41 N , (ii) 6.0 N (b) (i) $5.4 \mathbf{i} - 1.0 \mathbf{j}$ (ii) 5.5 N at 10.5° below the x-axis

(c) $0.6 \mathbf{i} + 10.0 \mathbf{j}$ (ii) 100 N at 87° above the x-axis