Bedok View Secondary School
Department of Mathematics

Mark Scheme

Year	2025	Level & Stream	4E5N
Type of Assessment	Preliminary Exam	Subject & Paper	Additional Math P1

Qns	Working
1	$4x^2-6xy-6y=4$ ----(1) $y-x=4$ ------(2) Sub (2) into (1): $4x^2-6x(4+x)-6(4+x)=4$ $4x^2-24x-6x^2-24-6x=4$ $2x^2+30x+28=0$ $x^2+15x+14=0$ $(x+1)(x+14)=0$ $x=-14$ or $x=-1$ $y=-10$ or $y=3$
2	$9\sin x=-2\sec x$ $9\sin x=-\frac{2}{\cos x}$ $\sin x\cos x=-\frac{2}{9}$ $2\sin x\cos x=-\frac{4}{9}$ $\sin 2x=-\frac{4}{9}$ Basic angle $=\sin^{-1}\left(\frac{4}{9}\right)$ $=0.46055$ $2x=-0.46055,\ -(\pi-0.46055)$ $=-0.46055$ or -2.68104 $x=-0.230$ or -1.34

Bedok View Secondary School
Department of Mathematics

Mark Scheme

Qns	Working
3a	Principal range of $\cos^{-1}x$ is $0 \le \cos^{-1}x \le \pi$, hence principal value of $\cos^{-1}\left(-\frac{\sqrt{2}}{2}\right)$ is $\frac{3\pi}{4}$ instead of $-\frac{\pi}{4}$.
3b	L.H.S: $\cot A + \tan A = \frac{1}{\tan A} + \tan A$ $= \frac{\cos A}{\sin A} + \frac{\sin A}{\cos A}$ $= \frac{\cos^2 A + \sin^2 A}{\sin A \cos A}$ $= \frac{1}{\sin A \cos A}$ $= \sec A \operatorname{cosec} A = \text{RHS (shown)}$ **OR** RHS: $\sec A \operatorname{cosec} A = \frac{1}{\cos A} \times \frac{1}{\sin A}$ $\frac{1}{\cos A \sin A}$ $= \frac{\sin^2 A + \cos^2 A}{\cos A \sin A}$ $= = \frac{\sin^2 A}{\cos A \sin A} + \frac{\cos^2 A}{\cos A \sin A}$ $= \frac{\sin A}{\cos A} + \frac{\cos A}{\sin A}$ $= \tan A + \cot A = \text{LHS (shown)}$

Bedok View Secondary School
Department of Mathematics

Mark Scheme

Qns	Working
4	By long division, $\frac{2x^3+4}{x(x+2)^2}=\frac{2x^3+4}{x^3+4x^2+4x}$ $=2+\frac{-8x^2-8x+4}{x(x+2)^2}$ $\frac{-8x^2-8x+4}{x(x+2)^2}=\frac{A}{x}+\frac{B}{x+2}+\frac{C}{(x+2)^2}$ $-8x^2-8x+4=A(x+2)^2+Bx(x+2)+Cx$ Let $x=0$: $4=4A$ $A=1$ Let $x=-2$: $-12=-2C$ $C=6$ Let $x=1$: $-8-8+4=9+3B+6$ $B=-9$ $\therefore \frac{2x^3+4}{x(x+2)^2}=2+\frac{1}{x}-\frac{9}{x+2}+\frac{6}{(x+2)^2}$
5a	$f'(x)=\frac{(x^2+3)-2x(x+a)}{(x^2+3)^2}$ $=\frac{-x^2-2ax+3}{(x^2+3)^2}$
5b	$\frac{-x^2-2ax+3}{(x^2+3)^2}>0$, for $b<x<1$ Since $(x^2+3)^2>0$, $-x^2-2ax+3>0$ $x^2+2ax-3<0$ Given that $b<x<1$ $(x-b)(x-1)<0$ $x^2-bx-x+b<0$ By comparing: $b=-3$ $2a=-b-1$ $2a=3-1$ $a=1$

Bedok View Secondary School
Department of Mathematics

Mark Scheme

Qns	Working
6	$y=(k-6)x^2-8x+k$ Discriminant $=(-8)^2-4(k-6)(k)$ $=64-4k^2+24k$ For curve that does not intersect the x-axis, Discriminant <0 $k^2-6k-16>0$ $(k+2)(k-8)>0$ $k<-2$ or $k>8$ The curve has a minimum point: $k-6>0$ $k>6$ $\therefore k>8$
7a	$\frac{\mathrm{d}}{\mathrm{d}x}\left[(x-1)\mathrm{e}^{-x}\right]=\mathrm{e}^{-x}-(x-1)\mathrm{e}^{-x}$ $=2\mathrm{e}^{-x}-x\mathrm{e}^{-x}$
7b	$\int 2\mathrm{e}^{-x}-x\mathrm{e}^{-x}\mathrm{d}x=(x-1)\mathrm{e}^{-x}+c$ $\int 2\mathrm{e}^{-x}\mathrm{d}x-\int x\mathrm{e}^{-x}\mathrm{d}x=(x-1)\mathrm{e}^{-x}+c$ $-\int x\mathrm{e}^{-x}\mathrm{d}x=-\int 2\mathrm{e}^{-x}\mathrm{d}x+(x-1)\mathrm{e}^{-x}+c$ $\int x\mathrm{e}^{-x}\mathrm{d}x=-2\mathrm{e}^{-x}-(x-1)\mathrm{e}^{-x}+c$ $=-2\mathrm{e}^{-x}-x\mathrm{e}^{-x}+\mathrm{e}^{-x}+c$ $=-\mathrm{e}^{-x}-x\mathrm{e}^{-x}+c$

Bedok View Secondary School
Department of Mathematics

Mark Scheme

Qns	Working
8a	$\frac{dr}{dt} = -\frac{2}{(t+1)^2}$ $r = -\int \frac{2}{(t+1)^2} dt$ $= -\int 2(t+1)^{-2} dt$ $= 2(t+1)^{-1} + c$ $r = \frac{2}{t+1} + c$ At $r = 4$ and $t = 0$, $4 = 2 + c$ $c = 2$ $r = \frac{2}{t+1} + 2$
8b	$A = \pi r^2$ $\frac{dA}{dr} = 2\pi r$ At $r = 2.6$, $\frac{dA}{dr} = 5.2\pi$, $2.6 = \frac{2}{t+1} + 2$ $0.6 = \frac{2}{t+1}$ $t = \frac{7}{3}$ $\frac{dr}{dt} = -\frac{2}{\left(\frac{7}{3}+1\right)^2} = -0.18$ $\frac{dA}{dt} = 5.2\pi \times -0.18$ $\frac{dA}{dt} = -0.936\pi \text{ cm}^2/\text{min}$

Bedok View Secondary School
Department of Mathematics

Mark Scheme

Qns	Working
9a	$y = kx + 6$ ---- (1) $2x^2 - xy = 3$ -----(2) Sub (1) into (2): $2x^2 - x(kx+6) = 3$ $2x^2 - kx^2 - 6x - 3 = 0$ $(2-k)x^2 - 6x - 3 = 0$ Discriminant $= (-6)^2 - 4(2-k)(-3)$ $= 60 - 12k$ For tangent, $60 - 12k = 0$ $k = 5$
9b	$\left(4 - 2\sqrt{2}\right)x + \sqrt{2} = 3x\sqrt{2} - 1$ $4x - 2x\sqrt{2} + \sqrt{2} = 3x\sqrt{2} - 1$ $\sqrt{2} + 1 = 3x\sqrt{2} + 2x\sqrt{2} - 4x$ $\sqrt{2} + 1 = x\left(5\sqrt{2} - 4\right)$ $x = \frac{\sqrt{2}+1}{5\sqrt{2}-4} \times \frac{5\sqrt{2}+4}{5\sqrt{2}+4}$ $= \frac{5(2) + 4\sqrt{2} + 5\sqrt{2} + 4}{\left(5\sqrt{2}\right)^2 - 4^2}$ $= \frac{9\sqrt{2} + 14}{50 - 16}$ $= \frac{9}{34}\sqrt{2} + \frac{7}{17}$

Bedok View Secondary School
Department of Mathematics

Mark Scheme

Qns	Working
10a	Area of $\Delta PQR = \frac{1}{2}\begin{vmatrix} 1 & 2 & 0 & 1 \\ 0 & 3 & 2 & 0 \end{vmatrix}$ $= \frac{1}{2}[3+4-2]$ $= 2.5 \text{ units}^2$
10b	$m_{PR} = \frac{3-0}{2-1}$ $= 3$ $m_{QS} = -\frac{1}{3}$ Equation of QS: $y-2 = -\frac{1}{3}(x-0)$ $y = -\frac{1}{3}x + 2 --- (1)$ $x - y = 5 --- (2)$ Sub (1) into (2): $x + \frac{1}{3}x - 2 = 5$ $x = \frac{21}{4}$ $y = \frac{1}{4}$ coordinates of $S = \left(\frac{21}{4}, \frac{1}{4}\right)$

Bedok View Secondary School
Department of Mathematics

Mark Scheme

Qns	Working
11a	$2^x + 4^{x-1} = 24$ $2^x + (4^x)(4^{-1}) = 24$ $2^x + \frac{2^{2x}}{4} = 24$ Let $y = 2^x$, $y + \frac{y^2}{4} = 24$ $4y + y^2 = 96$ $y^2 + 4y - 96 = 0$ $(y-8)(y+12) = 0$ $y = 8$ or $y = -12$ $2^x = 8$ or $2^x = -12$ (Rejected since $2^x > 0$) $2^x = 2^3$ $x = 3$
11b	$\log_{\sqrt{3}}(x-1) = \log_3(x+5)$ $\frac{\log_3(x-1)}{\log_3\sqrt{3}} = \log_3(x+5)$ $\frac{\log_3(x-1)}{\log_3 3^{\frac{1}{2}}} = \log_3(x+5)$ $2\log_3(x-1) = \log_3(x+5)$ $\log_3(x-1)^2 = \log_3(x+5)$ $(x-1)^2 = x+5$ $x^2 - 2x + 1 - x - 5 = 0$ $x^2 - 3x - 4 = 0$ $(x+1)(x-4) = 0$ $x + 1 = 0$ $x = -1$ [N.A. as $\log_{\sqrt{3}}(x-1)$ will be undefined] or $x - 4 = 0$ $x = 4$

Bedok View Secondary School
Department of Mathematics

Mark Scheme

Qns	Working
12a	$4x-4y=3$ $y=x-\frac{3}{4}$ m of normal $=1$ m of tangent $=-1$ At $x=\frac{1}{2}$ and $\frac{dy}{dx}=-1$, $6\left(\frac{1}{2}\right)-\frac{1}{k\left(\frac{1}{2}\right)^3}=-1$ $3-\frac{8}{k}=-1$ $k=2$ (shown)
12b	At stat points, $6x-\frac{1}{2x^3}=0$ $6x=\frac{1}{2x^3}$ $x^4=\frac{1}{12}$ $x=\pm\sqrt[4]{\frac{1}{12}}$ $x=-0.537$ or 0.537
12c	$\frac{d^2y}{dx^2}=6+\frac{3}{2x^4}$ $6>0$ $\frac{3}{2x^4}>0$ $\therefore \frac{d^2y}{dx^2}=6+\frac{3}{2x^4}>0$ Since $\frac{d^2y}{dx^2}=6+\frac{3}{2x^4}>0$ the gradient has no turning point.

Bedok View Secondary School
Department of Mathematics

Mark Scheme

Qns	Working
13a	$C = 1.2n^2 - 14.4n + 53.7$ At $n = 0$, $C = \$53.7$ thousands
13b	$C = 1.2n^2 - 14.4n + 53.7$ $= 1.2\left[n^2 - 12n + 44.75\right]$ $= 1.2\left[(n-6)^2 - 6^2 + 44.75\right]$ $= 1.2(n-6)^2 + 10.5$
13c	For 600 pairs of running shoes produced, the minimum cost of 10.5 thousand dollars will be incurred.
13d	$1.2(n-6)^2 + 10.5 = 50$ $1.2(n-6)^2 = 39.5$ $(n-6)^2 = \frac{39.5}{1.2}$ $n - 6 = \pm 5.7373$ $n = 11.7373$ or 0.2627 Maximum number of pairs of running shoes for which the cost is at most 50 thousand dollars = 11.7373 = 11.7 hundreds

Bedok View Secondary School
Department of Mathematics

Mark Scheme

Qns	Working
14a	$m_{AB}=1$ Equation of AB: $y+2=x+4$ $y=x+2----(1)$ $y=-x+4----(2)$ $(1)=(2): x+2=-x+4$ $2x=2$ $x=1$ $y=3$ Coordinates of $A=(1, 3)$
14b	Radius $=\sqrt{(1+4)^2+(3+2)^2}$ $=\sqrt{50}$ units Equation of circle: $(x+4)^2+(y+2)^2=50$
14c	Let the coordinates of the other end of the diameter passes through $A=C(x, y)$. Since AC is the diameter, B is the midpoint of AC. $\left(\frac{x+1}{2}, \frac{y+3}{2}\right)=(-4, -2)$ $\frac{x+1}{2}=-4, \quad \frac{y+3}{2}=-2$ $x=-9, y=-7$ Equation of another tangent which is parallel to $y=-x+4$: $y+7=-1(x+9)$ $y=-x-16$

Bedok View Secondary School
Department of Mathematics

Mark Scheme

Year	2025	**Level & Stream**	4E
Type of Assessment	Preliminary Exam	**Subject & Paper**	Additional Math P2

Qns	Working
1a	$\mathrm{N}(x) = x^2 \ln\left(\frac{2}{x}\right)$ let $u = x^2$ and $v = \ln\left(\frac{2}{x}\right)$ $\frac{\mathrm{d}u}{\mathrm{d}x} = 2x \qquad v = \ln 2 - \ln x$ $\frac{\mathrm{d}v}{\mathrm{d}x} = -\frac{1}{x}$ $\mathrm{N}'(x) = x^2.\left(-\frac{1}{x}\right) + \ln\left(\frac{2}{x}\right).2x$ $= -x + 2x\ln\left(\frac{2}{x}\right)$
b	stationary point $\mathrm{N}'(x) = 0$ $-x + 2x\ln\left(\frac{2}{x}\right) = 0$ $x\left(-1 + 2\ln\left(\frac{2}{x}\right)\right) = 0$ $x = 0$ (rej) or $-1 + 2\ln\left(\frac{2}{x}\right) = 0$ $2\ln\left(\frac{2}{x}\right) = 1$ $\ln\left(\frac{2}{x}\right) = \frac{1}{2}$ $e^{0.5} = \frac{2}{x}$ $x = 2 \div e^{0.5}$ $x = 1.21306$

x	1.1	1.21306	1.3
Sign of N'(x)	+ve	0	−ve
Sketch of tangent	/	—	\

$\therefore$ max absorption rate at $x = 1.21$ (3 s.f.)

Bedok View Secondary School
Department of Mathematics

Mark Scheme

Qns	Working
2a	$T = 22 + Ae^{kt}$ when $t = 0$, $T = 90$ $90 = 22 + Ae^{k(0)}$ $90 = 22 + A$ $A = 68$
b	when $t = 3.5$, $T = 79$ $79 = 22 + 68e^{k(3.5)}$ $57 = 68e^{k(3.5)}$ $\frac{57}{68} = e^{k(3.5)}$ $\ln\left(\frac{57}{68}\right) = k(3.5)$ $k = \ln\left(\frac{57}{68}\right) \div 3.5$ $k = -0.050416$ $k = -0.0504$ (3 s.f.)
c	$T = 22 + 68e^{-0.050416t}$ when $t = 10$, $T = 22 + 68e^{-0.050416(10)}$ $= 63.0728$ Since 63.0728 °C is between 55 °C and 70 °C, the coffee is suitable to be served.
d	After a long time, T approaches 22 °C.

Bedok View Secondary School
Department of Mathematics

Mark Scheme

Qns	Working
3a	$\cos\theta = \dfrac{ED}{14}$ $ED = 14\cos\theta$ Let G be the point on FD such that $BG \perp FD$ $\sin\theta = \dfrac{EG}{3}$ $EG = 3\sin\theta$ $FD = 14\cos\theta + 3\sin\theta + 6$ (shown)
b	$R = \sqrt{14^2 + 3^2}$ $= \sqrt{205}$ $\tan\alpha = \dfrac{3}{14}$ $\alpha = 12.0947$ $FD = \sqrt{205}\cos(\theta - 12.1°) + 6$ (3 s.f.)
c	$\sqrt{205}\cos(\theta - 12.0947°) + 6 = 12$ $\cos(\theta - 12.0947°) = \dfrac{6}{\sqrt{205}}$ $\theta - 12.0947° = 65.2248°$ $\theta = 77.3195°$ $\theta = 77.3°$ (1 d.p.)
d	Maximum $\sqrt{205}\cos(\theta - 12.0947°) + 6$ $= \sqrt{205} + 6$ $= 20.317$ $\therefore$ it is possible for FD to be 15 cm Or $\sqrt{205}\cos(\theta - 12.0947°) + 6 = 15$ $\cos(\theta - 12.0947°) = \dfrac{9}{\sqrt{205}}$ $\theta - 12.0947° = 51.054°$ $\theta = 63.1°$ (1 d.p.) FD is 15 cm when $\theta = 63.1°$

Bedok View Secondary School
Department of Mathematics

Mark Scheme

Qns	Working
4a	

Bedok View Secondary School
Department of Mathematics

Mark Scheme

Qns	Working
b	$N = a10^{kt}$ $\lg N = \lg a10^{kt}$ $\lg N = \lg a + \lg 10^{kt}$ $\lg N = \lg a + kt$ $\lg N = kt + \lg a$ $k = \text{gradient}$ $= 0.232$ (3 s.f.) ± 0.1 $\lg a = \text{vertical axis} - \text{intercept}$ $\lg a = 2.5 \pm 0.05$ $a = 10^{2.5}$ $=316$ (3 s.f.)
5a	$-2(x+1)(x-2)(x-1.5)$ $= (x^2 - x - 2)(-2x+3)$ $= -2x^3 + 3x^2 + 2x^2 - 3x + 4x - 6$ $= -2x^3 + 5x^2 + x - 6$
b	$x^2 + 0x - 1 \overline{)\, x^3 - 3x^2 - 2x + 5}$ with quotient $x - 3$ $-(x^3 + 0x^2 - x)$ $-3x^2 - x + 5$ $-(-3x^2 + 0x + 3)$ $-x + 2$ $\therefore$ Quotient $= x - 3$

Bedok View Secondary School
Department of Mathematics

Mark Scheme

Qns	Working

c	$hx^3-7x^2+kx-2=\left(3x^2-5x-2\right)\times\text{Quotient}$
	$hx^3-7x^2+kx-2=(3x+1)(x-2)\times\text{Quotient}$
	sub $x=-\frac{1}{3}$, $h\left(-\frac{1}{3}\right)^3-7\left(-\frac{1}{3}\right)^2+k\left(-\frac{1}{3}\right)-2=0$
	$-\frac{1}{27}h-\frac{1}{3}k=\frac{25}{9}$----------(1)
	sub $x=2$, $h(2)^3-7(2)^2+k(2)-2=0$
	$8h+2k=30$----------(2)
	From (2), $4h+k=15$
	$k=15-4h$----------(3)
	sub (3) into (1), $-\frac{1}{27}h-\frac{1}{3}(15-4h)=\frac{25}{9}$
	$-\frac{1}{27}h-5+\frac{4}{3}h=\frac{25}{9}$
	$\frac{35}{27}h=\frac{70}{9}$
	$h=6$
	sub $h=6$ into (3), $k=15-4(6)$
	$k=-9$

Bedok View Secondary School
Department of Mathematics

Mark Scheme

Qns	Working
6a	$AB = AE$ (tangent from external point) $AC = AD$ (tangent from external point) $\frac{AB}{AC} = \frac{AE}{AD}$ (ratio of corresponding sides are equal) $\angle BAE = \angle CAD$ (common angle) ΔABE is similar to ΔACD (ratio of 2 pairs of corresponding sides and a pair of included $\angle$s are equal)
b	$\angle ABE = \angle ACD$ (ΔABE is similar to ΔACD) $\angle ACD = \angle ADC$ (base $\angle$ of isosceles Δ) $\angle EBC = 180° - \angle ABE$ (adjacent $\angle$s on a straight line) Since $\angle ADC + \angle EBC = 180°$, by the converse of angles in opposite segments, a circle can be drawn to pass through $BEDC$.
c	Let $\angle CBF = x$, $\angle BEF = x$ (alternate segment thm) $BE // CD$ since ΔABE is similar to ΔACD $\angle ECD = x$ (alternate angles, $BE // CD$) $\angle EDF = x$ (alternate segment thm) $\therefore \angle CBF = \angle EDF$ (proven)

Bedok View Secondary School
Department of Mathematics

Mark Scheme

Qns	Working
7a	General term of $\left(1-\frac{x}{5}\right)^8$ $=\binom{8}{r}(1)^{8-r}\left(-\frac{x}{5}\right)^r$ $=\binom{8}{r}\left(-\frac{x}{5}\right)^r$ $(7+2x)\left(1-\frac{x}{5}\right)^8$ $=(7+2x)\left(\ldots+\binom{8}{3}\left(-\frac{x}{5}\right)^3+\binom{8}{2}\left(-\frac{x}{5}\right)^2+\ldots\right)$ x^3 term $=7\binom{8}{3}\left(-\frac{x}{5}\right)^3+2x\binom{8}{2}\left(-\frac{x}{5}\right)^2$ $=7(56)\left(-\frac{x^3}{125}\right)+2x(28)\left(\frac{x^2}{25}\right)$ $=-\frac{392}{125}x^3+\frac{56}{25}x^3$ Coefficient of x^3 $=-\frac{112}{125}$
b	$\binom{n}{2}3^{n-2}\left(\frac{1}{2}x\right)^2=\binom{n}{2}3^{n-2}\frac{1}{4}x^2$ $\binom{n}{3}3^{n-3}\left(\frac{1}{2}x\right)^3=\binom{n}{3}3^{n-3}\frac{1}{8}x^3$ $\binom{n}{2}3^{n-2}\frac{1}{4}=3\times\binom{n}{3}3^{n-3}\frac{1}{8}$ $\binom{n}{2}3^{n-2}.2=\binom{n}{3}3^{n-2}$ $\binom{n}{2}.2=\binom{n}{3}$ $\frac{n(n-1)}{2}.2=\frac{n(n-1)(n-2)}{2\times3}$ $6=n-2$ $n=8$

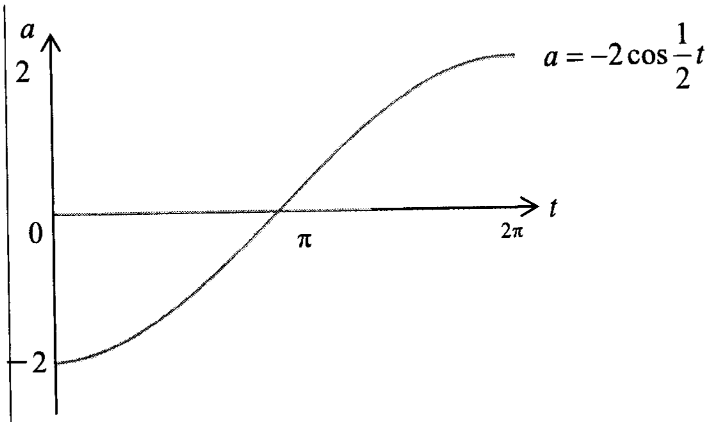
Bedok View Secondary School
Department of Mathematics

Mark Scheme

Qns	Working
8a	$\cos 2A = \frac{1}{3}$ $1 - 2\sin^2 A = \frac{1}{3}$ $\sin^2 A = \frac{1}{3}$ $\sin A = \frac{1}{\sqrt{3}}$ or $-\frac{1}{\sqrt{3}}$ (rej) $\text{cosec } A = \frac{1}{\sin A}$ $= 1 \div \frac{1}{\sqrt{3}}$ $= \sqrt{3}$
b	$\sin 105°$ $= \sin(45° + 60°)$ $= \sin 45° \cos 60° + \cos 45° \sin 60°$ $= \frac{1}{\sqrt{2}} . \frac{1}{2} + \frac{1}{\sqrt{2}} . \frac{\sqrt{3}}{2}$ $= \frac{1+\sqrt{3}}{\sqrt{2}.2}$ $\text{cosec } A - \sqrt{2} \sin 105°$ $= \sqrt{3} - \sqrt{2} . \frac{1+\sqrt{3}}{\sqrt{2}.2}$ $= \sqrt{3} - \frac{1+\sqrt{3}}{2}$ $= \frac{\sqrt{3}-1}{2}$

Bedok View Secondary School
Department of Mathematics

Mark Scheme

Qns	Working
9a	
b	$v=\int -2\cos\frac{1}{2}t\ dt$ $=\dfrac{-2\sin\frac{1}{2}t}{\frac{1}{2}}+c$ $=-4\sin\frac{1}{2}t+c$ Given $t=0$ and $v=3$, find c $3=-4\sin\frac{1}{2}(0)+c$ $c=3$ $v=-4\sin\frac{1}{2}t+3$ find t when $v=0$, $-4\sin\frac{1}{2}t+3=0$ $\sin\frac{1}{2}t=\frac{3}{4}$ basic $\angle$ of $\frac{1}{2}t=0.84806$ $t=1.6961$ $t=1.70$ (3 s.f.)

Bedok View Secondary School
Department of Mathematics

Mark Scheme

Qns	Working
c	basic $\angle$ of $\frac{1}{2}t = 0.84806$ since $\sin\frac{1}{2}t$ is +ve, $\frac{1}{2}t$ is also in 2nd quad. $\frac{1}{2}t = \pi - 0.84806$ $\frac{1}{2}t = 2.2935$ $t = 4.5870$ Displacement $= \int\left(-4\sin\frac{1}{2}t + 3\right)\mathrm{d}t$ $= -4.\dfrac{-\cos\frac{1}{2}t}{\frac{1}{2}} + 3t + C_1$ $= 8\cos\frac{1}{2}t + 3t + C_1$ Distance travelled in first 5 min $= \left\|\left[8\cos\frac{1}{2}t + 3t\right]_0^{1.6961}\right\| + \left\|\left[8\cos\frac{1}{2}t + 3t\right]_{1.6961}^{4.5870}\right\| + \left\|\left[8\cos\frac{1}{2}t + 3t\right]_{4.5870}^{5}\right\|$ $= \|10.379 - 8\| + \|8.4696 - 10.379\| + \|8.5908 - 8.4696\|$ $= 2.3798 + 1.9100 + 0.1212$ $= 4.41$ m

Bedok View Secondary School
Department of Mathematics

Mark Scheme

Qns	Working
10a	$y = 2x - 1 ------ (1)$ $y = -x^{\frac{3}{2}} -------- (2)$ fr (2), $y^2 = x^3 --- (3)$ sub (1) into (3), $(2x-1)^2 = x^3$ $4x^2 - 4x + 1 = x^3$ $0 = x^3 - 4x^2 + 4x - 1$ $(x-1)$ is a factor since $A(1,1)$ is intersection $0 = (x-1)(Ax^2 + Bx + C)$ $x^3 - 4x^2 + 4x - 1 = (x-1)(Ax^2 + Bx + C)$ compare x^3 : $1 = A$ compare constant: $-1 = -C$ $1 = C$ sub $x = 2$, $-1 = 2^2 + 2B + 1$ $-3 = B$ $(x-1)(x^2 - 3x + 1) = 0$ $x - 1 = 0$ or $x^2 - 3x + 1 = 0$ $x = 1$ $\quad x = \frac{-(-3) \pm \sqrt{(-3)^2 - 4(1)(1)}}{2(1)}$ $= 2.6180$ or 0.381966 sub $x = 0.381966$, $y = 2x - 1$ $y = 2(0.381966) - 1$ $= -0.236068$ $\therefore C = (0.38197, -0.23607)$ (shown)

Bedok View Secondary School
Department of Mathematics

Mark Scheme

Qns	Working
b	sub $y=0$ to find $x-$coordinate of B $y=2x-1$ $0=2x-1$ $x=0.5$ Let A be the shaded area above the x-axis Let B be the shaded area below the x-axis $A=\left\|\int_0^1 x^{\frac{3}{2}}\mathrm{d}x\right\|-\frac{1}{2}(0.5)(1)$ $=\left[\frac{x^{\frac{5}{2}}}{\frac{5}{2}}\right]_0^1-0.25$ $=\frac{2}{5}-0.25$ $=0.15$ units^2 $B=\int_0^{0.38197}-x^{\frac{3}{2}}\mathrm{d}x+\frac{1}{2}(0.5-0.38197)(0.23607)$ $=\left\|\left[-\frac{x^{\frac{5}{2}}}{\frac{5}{2}}\right]_0^{0.38197}\right\|+0.013931$ $=0.03606089+0.0139391$ $=0.049999$ units^2 Total shaded area $=0.15+0.049999$ $=0.200$ units^2 (3 s.f.)