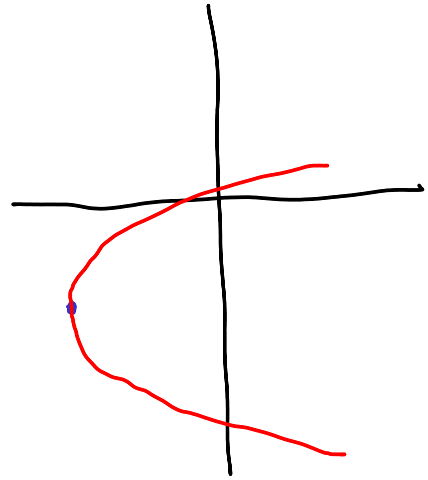
1 [10] $2y^2+14=x+12y$

parabola $x=2(y+3)^2-4$

$a=2 \quad V=(-4,-3)$



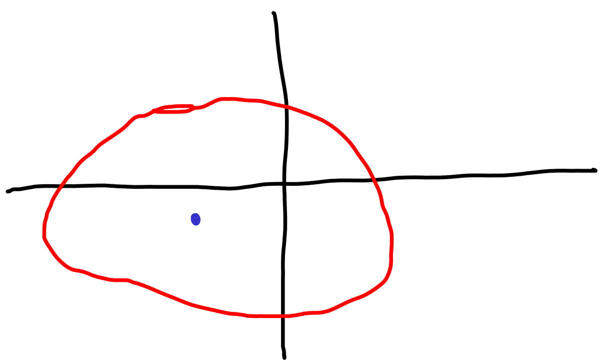
$$\frac{1}{5}x^2+\frac{1}{4}y^2+\frac{2}{5}x+\frac{1}{6}y=\frac{139}{180}$$

ellipse $\dfrac{(x+1)^2}{5}+\dfrac{(y+\frac{1}{3})^2}{4}=1$

$M=(-1,-\frac{1}{3})$

$a=\sqrt{5}$

$b=2$



2 [10]

$$\frac{\dfrac{x^2-14x+48}{x^2-64}}{\dfrac{x^2-5x-6}{x^2+10x+16}}=\frac{\dfrac{\cancel{(x-8)}\cancel{(x-6)}}{\cancel{(x-8)}\cancel{(x+8)}}}{\dfrac{\cancel{(x-6)}(x+1)}{\cancel{(x+8)}(x+2)}}=\frac{x+2}{x+1}$$

$$\sqrt{(x^2-3)^2-(2x+4)(2x-4)}=\sqrt{x^4-6x^2+9-4x^2+16}=$$

$$\sqrt{x^4-10x^2+25}=\sqrt{(x^2-5)^2}=x^2-5$$

3 [5] $\overline{AB}^2 = 392^2 + 786^2 - 2 \cdot 392 \cdot 786 \cdot \cos 53^\circ 28'$

$\overline{AB} = 636.10$

4 [5] $\frac{1}{2} = 1 \cdot e^{\frac{4}{k}} \to \ln\frac{1}{2} = \frac{4}{k} \to k = \frac{4}{\ln\frac{1}{2}}$

$\frac{1}{10} = 1 \cdot e^{\frac{d}{k}} \to \ln\frac{1}{10} = \frac{d}{k} \to d = k \cdot \ln\frac{1}{10}$

$d \cong 13.288$ (feet)

5 [12] (i) $8^x = \frac{8}{2^{x-3}}$ $\quad 2^{3x} = 2^{3-x+3}$

$3x = 6 - x$

$4x = 6 \quad x = \frac{6}{4} \quad S = \{\frac{3}{2}\}$

(ii) $\sin 2x \cos x = \sin x$

$2 \sin x \cos^2 x = \sin x$

$\sin x (2\cos^2 x - 1) = 0$

$\sin x = 0$ or $\cos x = \mp \frac{1}{\sqrt{2}}$

$S = \{0^\circ, 180^\circ, 45^\circ, 135^\circ, 225^\circ, 315^\circ\}$

(iii) $\ln(x) - \ln(x+3) = -1$

$\ln \frac{x}{x+3} = -1$

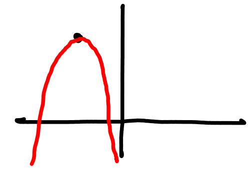
$\frac{x}{x+3} = \frac{1}{e}$

$ex = x + 3$

$(e-1)x = 3 \quad x = \frac{3}{e-1}$

$S = \{\frac{3}{e-1}\} = \{1.7459\}$

① [10] (i) $3x^2+8=-12x-y$



parabola $\quad a=-3 \quad V=(-2,4)$

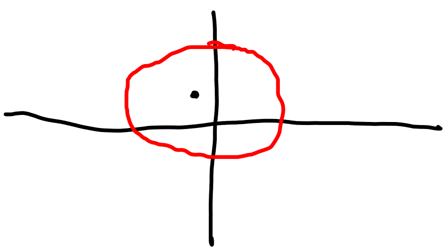
$$y=-3(x+2)^2+4$$

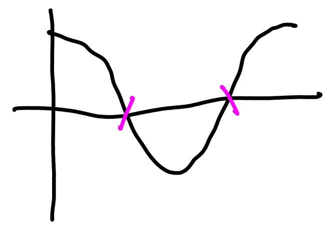
(ii) $\frac{1}{4}x^2+\frac{1}{2}y^2+\frac{1}{4}x=y+\frac{7}{16}$ ellipse

$$\frac{(x+\frac{1}{2})^2}{4}+\frac{(y-1)^2}{2}=1$$

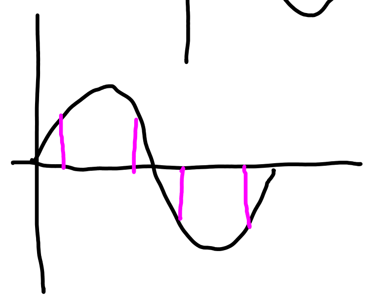
$M=(-\frac{1}{2},1)$

$a=2 \quad b=\sqrt{2}$





⑤ [12] $\sin 2x\cdot\sin x-\cos x=0$



$$\cos x\left(2\sin^2 x-1\right)=0$$

$S=\{45^\circ, 90^\circ, 135^\circ, 225^\circ, 270^\circ, 315^\circ\}$

$$\ln x+\ln(x-9)=1$$

$$\ln(x-9)x=1$$

$$x_{1,2}=\frac{9\mp\sqrt{81+4e}}{2}$$

$$x^2-9x=e$$

$S=\{-0.2925, 9.2925\}$

$$x^2-9x-e=0$$

2 [10] (i) $$\frac{x^2-3x-10}{x^2-25} \div \frac{x^2-6x-16}{x^2+x-20} =$$

$$\frac{\cancel{(x-5)}\cancel{(x+2)}}{\cancel{(x-5)}\cancel{(x+5)}} \cdot \frac{\cancel{(x+5)}(x-4)}{(x-8)\cancel{(x+2)}} = \frac{x-4}{x-8}$$

(ii) $$\sqrt{(x^2-5)^2-(4x+12)(4x-12)} =$$

$$\sqrt{x^4-10x^2+25-16x^2+144} =$$

$$\sqrt{x^4-26x^2+169} = \sqrt{(x^2-13)^2} = x^2-13$$

3 [5] $$\tan\varphi = \frac{\frac{3}{8}}{\sqrt{1^2+2^2}} = \frac{3}{8\cdot\sqrt{5}} \rightarrow \phi = 9.5202^\circ$$

4 [5] $$0.6 = 2^{-\frac{t}{5500}}$$

$$\ln 0.6 = -\frac{t}{5500}\cdot\ln 2$$

$$t = \frac{\ln 0.6}{\ln 2}\cdot(-5500) = 4053.3 \text{ (yrs)}$$

5 [12] $$9^x = \frac{27}{3^{x-2}} \qquad 3^{2x} = 3^{3-x+2} \qquad S = \left\{\frac{5}{3}\right\}$$