

$$\textcircled{1} \quad m = \tan 30^\circ$$

$$= \frac{1}{\sqrt{3}}$$

$$y = \frac{1}{\sqrt{3}}x + 4$$

$$\textcircled{2}(a) \quad u_1 = 20$$

$$u_2 = \frac{1}{5}u_1 + 12$$

$$= \frac{1}{5}(20) + 12$$

$$= 4 + 12$$

$$= 16$$

$$(b) (i) \quad -1 < \frac{1}{5} < 1$$

$$(ii) \quad \text{Limit} = \frac{12}{1 - \frac{1}{5}} = \frac{12}{\frac{4}{5}} = 12 \times \frac{5}{4} = 5 \times 3 = 15$$

$$\textcircled{3} \quad y = (5x^2 + 3)^7$$

$$\frac{dy}{dx} = 7(5x^2 + 3)^6(10x)$$

$$= 70x(5x^2 + 3)^6$$

$$\textcircled{4} \quad x: \quad -1 - (-6) = 5$$

$$\frac{2}{5} \text{ of } 5 = 2$$

$$-6 + 2 = -4$$

$$y: \quad 11 - 1 = 10$$

$$\frac{2}{5} \text{ of } 10 = 4$$

$$1 + 4 = 5$$

$$z: \quad -8 - 2 = -10$$

$$\frac{2}{5} \text{ of } -10 = -4$$

$$2 + (-4) = -2$$

$$R(-4, 5, -2)$$



$$\textcircled{5} \quad h(x) = 2x^3 - 7$$

$$y = 2x^3 - 7$$

$$y+7 = 2x^3$$

$$\frac{y+7}{2} = x^3$$

$$x = \sqrt[3]{\frac{y+7}{2}}$$

$$h^{-1}(y) = \sqrt[3]{\frac{y+7}{2}}$$

$$h^{-1}(x) = \sqrt[3]{\frac{x+7}{2}}$$

$$\textcircled{6} \text{(a)(i)} \quad \sin 2p = 2 \sin p \cos p$$

$$= 2 \left( \frac{1}{\sqrt{5}} \right) \left( \frac{2}{\sqrt{5}} \right)$$

$$= \frac{4}{5}$$

$$\begin{aligned} a^2 &= (\sqrt{5})^2 - 1^2 \\ &= 5 - 1 \\ &= 4 \\ a &= 2 \end{aligned}$$

$$\text{(ii)} \quad \cos 2p = 1 - 2 \sin^2 p$$

$$= 1 - 2 \left( \frac{1}{\sqrt{5}} \right)^2$$

$$= 1 - \frac{2}{5}$$

$$= \frac{3}{5}$$

$$\text{(b)} \quad \sin 4p = 2 \sin 2p \cos 2p$$

$$= 2 \times \frac{4}{5} \times \frac{3}{5}$$

$$= \frac{24}{25}$$



⑦ Subs  $y=2x$  into  $x^2 + y^2 - 14x - 8y + 45 = 0$

$$x^2 + (2x)^2 - 14x - 8(2x) + 45 = 0$$

$$5x^2 - 14x - 16x + 45 = 0$$

$$5x^2 - 30x + 45 = 0$$

$$x^2 - 6x + 9 = 0$$

$$(x-3)^2 = 0$$

$$x = 3$$

$$\therefore y = 2 \times 3 = 6$$

$$(3, 6)$$

⑧ No real roots so  $b^2 - 4ac < 0$

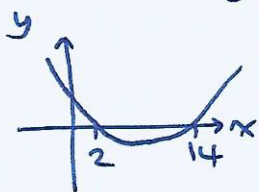
$$(m-4)^2 - 4(1)(2m-3) < 0$$

$$m^2 - 8m + 16 - 4(2m-3) < 0$$

$$m^2 - 8m + 16 - 8m + 12 < 0$$

$$m^2 - 16m + 28 < 0$$

$$(m-2)(m-14) < 0$$



$$2 < m < 14$$

⑨  $\log_a 5 + \log_a 80 - 2 \log_a 10 = \log_a 5 + \log_a 80 - \log_a 10^2$

$$= \log_a \frac{5 \times 80}{100}$$

$$= \log_a \frac{400}{100}$$

$$= \log_a 4$$



⑩ (a)

$$\begin{array}{r|rrrrr}
 1 & 2 & 3 & -4 & -3 & 2 \\
 & \downarrow & & & & \\
 & 2 & 5 & 1 & -2 & \\
 \hline
 & 2 & 5 & 1 & -2 & 0
 \end{array}$$

Remainder = 0

so  $(x-1)$  is a factor.

$$\text{So } 2x^4 + 3x^3 - 4x^2 - 3x + 2 = (x-1)(2x^3 + 5x^2 + x - 2)$$

(b)

$$\text{Try } x=1. \quad 2+5+1-2 \neq 0$$

$$\text{Try } x=-1. \quad -2+5-1-2 = 0$$

$$\begin{array}{r|rrrr}
 -1 & 2 & 5 & 1 & -2 \\
 & \downarrow & & & \\
 & 2 & 3 & -2 & \\
 \hline
 & 2 & 3 & -2 & 0
 \end{array}$$

$$\begin{aligned}
 & (x-1)(x+1)(2x^2+3x-2) \\
 & = (x-1)(x+1)(x+2)(2x-1)
 \end{aligned}$$

⑪ (a)

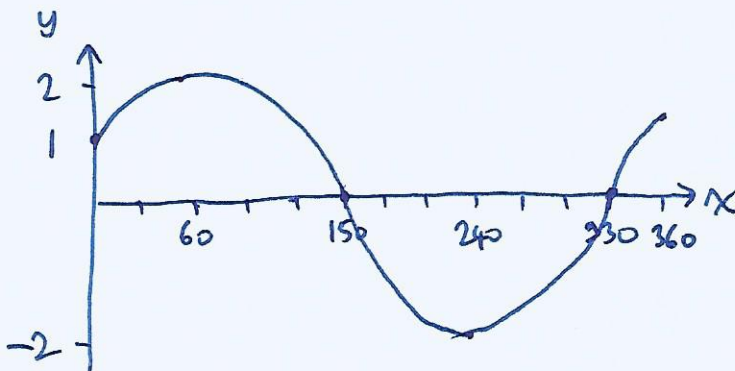
$$k \cos(x-a) = k \cos x \cos a + k \sin x \sin a$$

$$\left. \begin{aligned} k \cos a &= 1 \\ k \sin a &= \sqrt{3} \end{aligned} \right\} \begin{aligned} \tan a &= \sqrt{3} \\ a &= 60^\circ \end{aligned}$$

$$\begin{aligned}
 k^2 &= 1^2 + (\sqrt{3})^2 \\
 &= 1 + 3 \\
 &= 4 \\
 k &= 2
 \end{aligned}$$

$$2 \cos(x-60)^\circ$$

(b)



y-intercept:

$$\begin{aligned}
 y &= 2 \cos(0-60)^\circ \\
 &= 2 \cos 300^\circ \\
 &= 2 \cos 60^\circ \\
 &= 2 \times \frac{1}{2} \\
 &= 1
 \end{aligned}$$

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⑫

$$f(x) = 12 \sqrt[3]{x}$$

$$= 12x^{\frac{1}{3}}$$

$$f'(x) = 4x^{-\frac{2}{3}}$$

$$f'(a) = 1$$

$$\text{so } 4a^{-\frac{2}{3}} = 1$$

$$a^{-\frac{2}{3}} = \frac{1}{4}$$

$$a^{\frac{2}{3}} = 4$$

$$\sqrt[3]{a^2} = 4$$

$$a^2 = 4^3 = 64$$

$$a = \sqrt{64} = 8$$

⑬ (a) Midpoint of PQ =  $\left(\frac{4+6}{2}, \frac{10+2}{2}\right) = (5, 6)$ 

$$m_{PQ} = \frac{10-2}{4-6} = \frac{8}{-2} = -4$$

$$m_{\perp} = \frac{1}{4}$$

$$y-6 = \frac{1}{4}(x-5)$$

$$4(y-6) = x-5$$

$$4y-24 = x-5$$

$$4y = x+19$$

(b) Centre of circle has x-coordinate directly above the midpoint of QR.

$$x = \frac{6+12}{2} = 9$$

$$4y = x+19$$

$$= 9+19$$

$$= 28$$

$$y = 7$$

Centre (9, 7)

$$r^2 = (9-4)^2 + (7-10)^2$$

$$= 5^2 + (-3)^2$$

$$= 25 + 9$$

$$= 34$$

$$(x-9)^2 + (y-7)^2 = 34$$