

Specimen MA - C1

1)

$$\sum_{r=1}^n k = nk, \quad \sum_{r=1}^n r = \frac{1}{2}n(n+1)$$

$$\sum_{r=1}^{20} (5+2r) = \sum_{r=1}^{20} 5 + 2 \sum_{r=1}^{20} r$$

$$= (20 \times 5) + 2 \left[\frac{1}{2} 20(20+1) \right]$$

$$= 100 + 420$$

$$= 520$$

OR

$$S_n = \frac{1}{2}n[2a + (n-1)d]$$

$$S = 5 + 2r \therefore a=5, d=2$$

$$S_{20} = \frac{1}{2} 20 [2(5) + (20-1)2]$$

$$= 10 \times (10 + 38)$$

$$= 520$$

2)

$$\begin{aligned}
 \int (5x + 3\sqrt{x}) \, dx &= 5 \int x \, dx + 3 \int x^{\frac{1}{2}} \, dx \\
 &= 5 \frac{x^2}{2} + 3 \frac{2x^{\frac{3}{2}}}{\frac{3}{2}} + C \\
 &= \frac{5x^2}{2} + 2x^{\frac{3}{2}} + C
 \end{aligned}$$

3)

$$\begin{aligned}
 \sqrt{80} &= \sqrt{16} \times \sqrt{5} \\
 &= 4\sqrt{5}
 \end{aligned}$$

a)

b)

$$(a+b)^2 = a^2 + 2ab + b^2$$

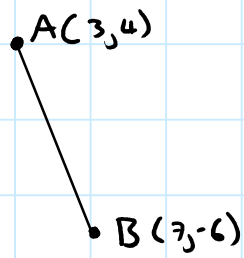
$$(4 - \sqrt{5})^2 = 4^2 + 2[4 \times -\sqrt{5}] + (-\sqrt{5})^2$$

$$= 16 - 8\sqrt{5} + 5$$

$$= 21 - 8\sqrt{5}$$

4)

gradient of AB



$$\frac{\Delta y}{\Delta x} = \frac{-6-4}{7-3}$$

$$= \frac{-10}{4}$$

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

Perpendicular to AB

$$\frac{2}{5} \quad \therefore \frac{2}{5}x - \frac{5}{2} = -1$$

$$y - y_1 = m(x - x_1)$$

using (3, 4) as (x_1, y_1)

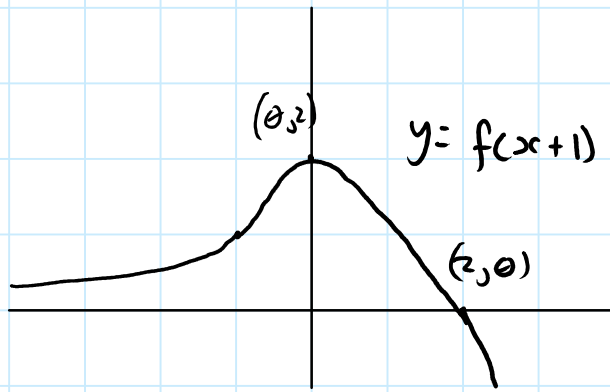
$$y - 4 = \frac{2}{5}(x - 3)$$

$$5y - 20 = 2x - 6$$

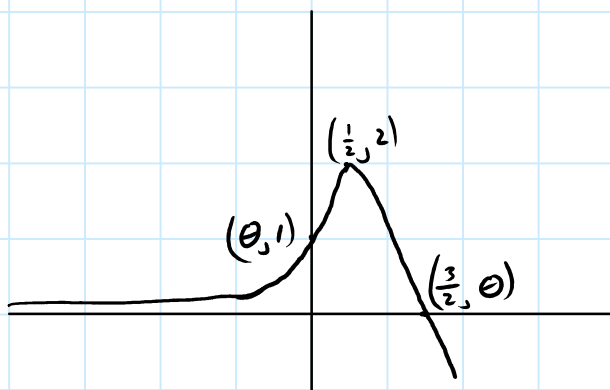
$$5y - 2x - 14 = 0 \quad \text{OR} \quad 2x - 5y + 14 = 0$$

5)

a)



b)



6)

$$y + 2x = 5$$

$$2x^2 - 3x - y = 16$$

a)

$$y = 5 - 2x$$

$$2x^2 - 3x - 5 + 2x = 16$$

$$2x^2 - x - 21 = 0$$

$$\frac{1 \pm \sqrt{1^2 - 4 \cdot 2 \cdot (-21)}}{4} = \frac{1 \pm 13}{4}$$

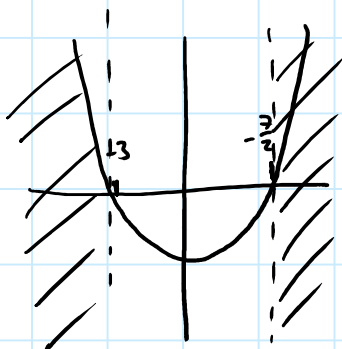
$$x = -3, \frac{7}{2}$$

$$y = 5 - 2x$$

$$\therefore y = 11, -2$$

b)

$$2x^2 - x - 21 > 0$$



$$x < -3 \cup x > \frac{7}{2}$$

Union, this means OR

$$7) \quad U_n = 250 + (n-1)50, \quad a = 250 \quad d = 50$$

$$a) \quad U_{11} = 250 + 500 \\ = \pounds 750$$

$$b) \quad S_{20} = \frac{1}{2} 20 [2(250) + (20-1)50] \\ = 10 [500 + 950] \\ = \pounds 14,500$$

$$c) \quad U_n = A + (n-1)60$$

$$S_{20} = \pounds 14,500$$

$$14,500 = \frac{1}{2} 20 [2A + (20-1)60]$$

$$1450 = 2A + 1140$$

$$2A = 310$$

$$A = \pounds 155$$

$$g) \quad x^2 + 10x + 36 = (x+a)^2 + b$$

$$\frac{10}{2} = 5$$

$$(x+5)^2 = x^2 + 10x + 25$$

$$x^2 + 10x + 36 = (x+5)^2 + 11$$

$$b) \quad (x+5)^2 + 11 = 0$$

$$(x+5)^2 = -11$$

$$x+5 = \pm\sqrt{-11}$$

$$x = \pm\sqrt{-11} - 5$$

these are not real roots

O R

$$x^2 + 10x + 36$$

Using the discriminant:

$$b^2 - 4ac$$

$$10^2 - 4 \times 1 \times 36 = -44$$

$$-44 < 0 \therefore$$

no real roots

$$c) \quad (1) x^2 + 10x + k = 0$$

$$b^2 - 4ac = 0$$

Using discriminant

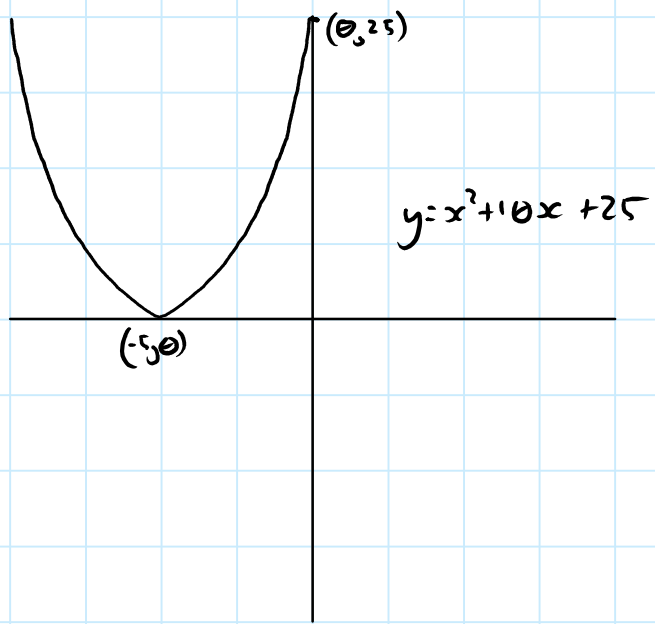
$$10^2 - 4(1)k = 0$$

$$100 = 4k$$

$$k = 25$$

g)

d)



$$a) \quad f'(x) = 3x^2 - 8x + 6$$

$$\begin{aligned} a) \quad f(x) &= \int f'(x) dx \\ &= 3 \frac{x^3}{3} - 8 \frac{x^2}{2} + 6 \frac{x^1}{1} + C \\ &= x^3 - 4x^2 + 6x + C \end{aligned}$$

$$\begin{aligned} f(3) &= 27 - 36 + 18 + C \\ &= 5 \end{aligned}$$

$$\therefore C = -4$$

$$f(x) = x^3 - 4x^2 + 6x - 4$$

$$\begin{aligned} b) \quad f(2) &= 8 - 16 + 12 - 4 \\ &= 0 \end{aligned}$$

9)

$$\begin{aligned} \text{c) } f'(3) &= 3(9) - 8(3) + 6 \\ &= 9 \end{aligned}$$

$$3x^2 - 8x + 6 = 9$$

$$3x^2 - 8x - 3 = 0$$

$$\frac{8 \pm \sqrt{64 - 36}}{6} = \frac{8 \pm 10}{6}$$

$$x = 3, -\frac{1}{3}$$

x co-ord of P is 3

$$\therefore x \text{ co-ord of } Q = -\frac{1}{3}$$

10)

$$a) \quad \frac{dy}{dx} = 3x^2 - 5 - 2x^{-2}$$

A:

$$\frac{dy}{dx}(1) = 3 - 5 - 2$$

$$= -4$$

B:

$$\frac{dy}{dx}(-1) = 3 - 5 - 2$$

$$= -4$$

b) at A

$$\frac{dy}{dx} = -4$$

gradient of normal is $\frac{1}{4}$

$$\therefore \frac{1}{4}x - 4 = -1$$

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

$$4y + 8 = x - 1$$

$$4y = x - 9$$

10)

Since the gradients at A and B are equal, so too are the gradients of normal at A and B

c)

gradient of Normal at B = $\frac{1}{4}$

$$y - 2 = \frac{1}{4}(x - (-1)) \quad \text{given } B(-1, 2)$$

$$4y - 8 = x + 1$$

$$4y = x + 9$$

x Values of P & Q are 0 by definition

y Value of P

y value of Q

$$4y = 0 - 9$$

$$\therefore y = \frac{-9}{4}$$

$$4y = 0 + 9$$

$$y = \frac{9}{4}$$

$$\frac{9}{4} - \left(\frac{-9}{4} \right) = \frac{9}{2}$$

$$\vec{PQ} = \frac{9}{2}$$