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Suggested solution to Maths Methods Exam 2 (Analysis tasks) 2004

Q1

a)

Use product rule where v =$(x-1)^2$; u = (x-2)

$f'(x) = (x-1)^2(1) + (x-2)(2)(x-1)$

However on expansion

$f'(x) \quad = x^2 - 2x + 1 + 2(x^2 - 3x + 2)$

$f'(x) \quad = x^2 - 2x + 1 + 2x^2 - 6x + 4$

collect like terms

$f'(x) \quad = 3x^2 - 8x + 5 = (x-1)(3x-5)$

$f'(x)$ =(x-1)(ux+v)

Now we **equate the Coefficients**

Hence **u = 3 v = 5**

b)

For turning points

$(x-1)(3x-5)$ = 0 using null law

x =1, x = $\frac{5}{3}$ $\therefore$ **a** = 1 **b** = $\frac{5}{3}$

c) As the Turning points are (1,1),($\frac{5}{3}, \frac{23}{27}$)

p should be >1 and > $\frac{23}{27}$)

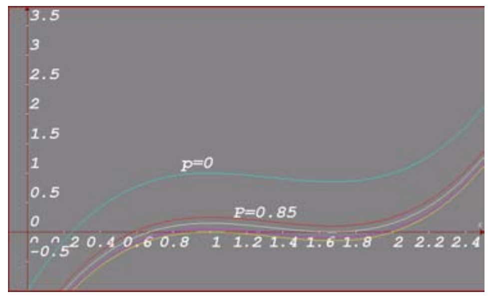
$1 < p < \frac{23}{27}$

How ? p = 0 one solution ie cuts x axis only once

$(x-1)^2(x-2) = 0$

$(x-1)^2(x-2)+1 = 0.95$ **p = 0.95**

Note as p increases how the graph tends to gives more than one solution



d) y = $x^3 - 4x^2 + 5x - 1 - 1$

y = $x^3 - 4x^2 + 5x - 2$ (using the factor theorem)

y = $(x-1)(x^2 - 3x + 2)$

y = $(x-1)(x-2)(x-1) = (x-1)^2(x-2)$

That helped us to sketch the graph but we need to remember that the required region is below x axis hence put negative sign

$$-\int_1^2 (x^3 - 4x^2 + 5x - 2)\,dx$$

$$-\left[\frac{x^4}{4} - \frac{4x^3}{3} + 5\frac{x^2}{2} - 2x\right]_1^2$$

$$-\left[\frac{x^4}{4}-\frac{4x^3}{3}+5\frac{x^2}{2}-2x\right]_1^2$$

$$-\left[\left(\frac{16}{4}-\frac{32}{3}+\frac{20}{2}-4\right)\right]-\left[\left(\frac{1}{4}-\frac{4}{3}+\frac{5}{2}-2\right)\right]$$

$$-\left[\left(\frac{-2}{3}\right)\right]-\left[\left(\frac{-7}{12}\right)\right]=$$

$$-\left[\left(\frac{-8}{12}\right)+\frac{7}{12}\right]=\frac{1}{12}\ =0.083$$

Q2

a) **1)** Here we use the law that $\sum \Pr(X = x) = 1$

$4k^2 + 4k + 5k^2 + 2k + k^2 + k + 2k = 1$

add all like terms

$\underline{10k^2 + 9k - 1 = 0}$

using the quadratic formula

a =10, b =9, c =-1

$$K = \frac{-9 \pm \sqrt{81 + 4x10x1`}}{20} = \frac{-9+11}{20} = 0.1$$

K=0.1

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b)

i

$$\Pr(\text{plane}) = \frac{14}{100} = 0.14$$

E(x) = np = 9x0.14= **1.26**

ii

$$\Pr(x = 2) = {}^9C_2\left(0.14^2\right)\left(.86^7\right) = 0.245$$

iii

Let **n** be the number required

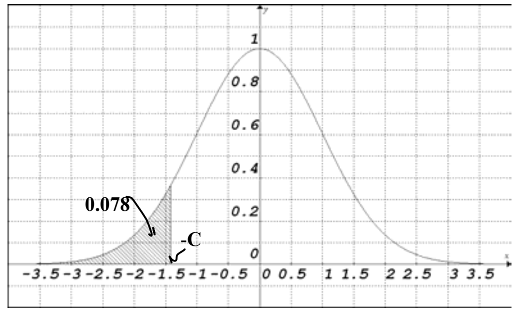
$${}^nC_0(0.14)^0(0.86)^n = 0.09$$

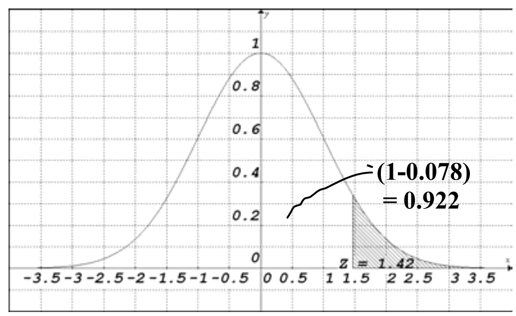
1x1(0.86)^n = 0.09…….Now take Logs on both sides.

$$Log_{10}(0.86)^n = Log_{10}(0.09)$$

$$nLog_{10}(0.86) = Log_{10}(0.09)$$

$$n = \frac{-1.0457}{-.06550} = 16$$





Pr(x<100) = 0.078 (given data)

But we cannot locate a negative Z

However using symmetry we can find

Z for area of 1-0.078 ie 0.922

Pr(Z<c) = 0.922

c = 1.4186

InvNorm(0.922,0,1)
1.4186

But we want –c ie –Z

$$Z = \frac{x - \mu}{\sigma}$$

$$-1.4186 = \frac{100 - 125}{\sigma}$$

$$\sigma = \frac{100 - 125}{-1.4186} = 17.62$$

$$\sigma = 18$$