

Adrian Galika - 1901402

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ACTIA 4000 / ACMA 4006

Q2.

a)

$$i) y = 8x^3 - 2x^2 + x + 10$$

$$\frac{dy}{dx} = 24x^2 - 4x + 1$$

$$ii) y = (5x - 3)(6x - 1)$$

$$y = 30x^2 - 5x - 18x + 3$$

$$y = 30x^2 - 23x + 3$$

$$\frac{dy}{dx} = 60x - 23$$

$$iii) y = \frac{3}{\sqrt{x}} + \ln x$$

$$iv) y = 5 \sin \frac{x}{2} - 6 \cos 3x - \tan \frac{2x}{3}$$

$$\frac{dy}{dx} = 2.5 \sin \frac{x}{2} + 18 \cos 3x + \frac{1}{3} \tan \frac{x}{3}$$

$$v) y = e^{7x} \tan 3x$$

$$\frac{dy}{dx} = (e^{7x})(\sin 3x) + (\tan 3x)(7e^{7x})$$

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vi) $y = \frac{\sin 2x}{e^{3x}}$

b) $y = \sin 2x$

~~$y' = \sin 2x$
 $y'' = \cos 2x$
 $y''' = -\sin 2x$
 $y^{(4)} = \cos 2x$~~

$$\begin{aligned} y' &= \cos 2x \\ y'' &= -\sin 2x \\ y''' &= -\cos 2x \\ y^{(4)} &= \sin 2x \end{aligned}$$

c) $z = x^5 + 3x^3y^2 + 4y^5$

$$\frac{\partial z}{\partial x} = 5x^4 + 6xy^2$$

$$\frac{\partial^2 z}{\partial x^2} = 20x^3 + 6y^2$$

$$\frac{\partial^2 z}{\partial y \partial x} = 3x^2y$$

$$\frac{\partial z}{\partial y} = 6x^3y + 20y^4$$

$$\frac{\partial^2 z}{\partial y^2} =$$

$$= 6x^3 + 80y^3$$

$$\frac{\partial^2 z}{\partial x \partial y} = 3x^2y$$

d) $y = 3x^2 + 16x + 30$

$$y = 2x^2 + 4x + 3$$

$$y =$$

$$0 = x^2 + 12x + 27$$

$$0 = (x+3)(x+9)$$

$$x = -3$$

$$x = -9$$

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c)

$$y = 5x^2 + 4x$$

$$\frac{dy}{dx} = 10x + 4$$

$$\frac{d^2y}{dx^2} = 10$$

$$6(10) - 5(10x + 4) + 7x - 1$$

$$60 - 50x - 20 + 7x - 1 = 39 - 43x$$

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Q3.

a)

$$12x^2 = 31x + 15$$

$$-12x^2 + 31x + 15 = 0$$

$$x = \frac{-31 \pm \sqrt{(31)^2 - 4(-12)(+15)}}{2(-12)}$$

$$x = \frac{+31 \pm \sqrt{961 + 720}}{-24}$$

$$x = \frac{+31 \pm \sqrt{1681}}{-24}$$

$$x = \frac{-5 + 41}{-24}$$

$$x = -1.5$$

$$x = \frac{-5 - 41}{-24}$$

$$x = 1.92$$

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b)

S	A
T	C

i) $\cos x = 0.62$

$$\cos^{-1} 0.62$$

$$x = \cancel{38.32^\circ} \quad \cancel{308.32^\circ} \quad 38.32^\circ$$

$$x = \cancel{141.68^\circ} \quad 311.68^\circ$$

ii) $7 \sin x = 4$

$$\sin x = \frac{4}{7}$$

$$x = 55.16^\circ$$

$$x = 124.84^\circ$$

iii) $-5 \tan x = 4$

$$\tan x = -\frac{4}{5}$$

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

$$x = 51.35^\circ$$

$$x = 218.65^\circ$$

iv) $-3 \sin x = -2$

$$\sin x = \frac{2}{3}$$

$$x = 228.19^\circ$$

$$x = 311.81^\circ$$

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d) $y = \sin^2\left(\frac{3\theta}{2}\right)$

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$$-\sin^2 y = \frac{3\theta}{2}$$

$$\frac{-\sin^2 y \times 2}{3} = \theta$$