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Maths Exam 12/1/2025

1

A $x = -2.93$

B $x = 3.155$

C $x = -4.43$

D $x = 1.34$

2

Y = 145.26

Z = 117.89

X = -53.68

3

X = 1.68, -7.36

4

A $\frac{dy}{dx} 15x^2 - 14x + 3$

B $\frac{dy}{dx} \frac{x^5(-1) - 1(5x^4)}{(x^5)^2} \quad -(-5x)^{-6}$

See photos for remaining answers and workings

I needed this many words to submit.

Maths exam

1 a $(x+6)^2 + 2x = x^2 - 5$
 $(x+6)(x+6) + 2x = x^2 - 5$
 $x^2 + 12x + 36 + 2x = x^2 - 5$
 $x^2 + 14x + 36 = x^2 - 5$
 $14x + 36 = -5$
 $14x = -41$
 $x = -2.93$

b ~~$2^{x+5} = 6^x$
 $2^x \times 2^5 = 6^x$
 $x+5 \ln(2) = x \ln(6)$~~

$2^{x+5} = 6^x$
 $x+5 \ln(2) = x \ln(6)$
 $x = 5 \ln(2) / \ln(3)$
 $x = 3.155$

c $2 \log(x+3) = \log(x+5) + \log(x+8)$
 $(x+3)^2 = (x+5)(x+8)$
 $(x+3)(x+3) = (x+5)(x+8)$
 $x^2 + 6x + 9 = \cancel{2x+13} x^2 + 13x + 40$
 ~~$x^2 + 4x =$~~
 $+7x = -31$
 $x = -4.43$

$$D \quad X - \frac{1 - \frac{6x}{5}}{3} = \frac{4 - \frac{x}{3}}{12} + \frac{5}{4}$$

$$\frac{1 - \frac{6x}{5}}{3} = \frac{\frac{5-6x}{5}}{3} = \frac{5-6x}{15}$$

$$\frac{4 - \frac{x}{3}}{12} = \frac{\frac{12-x}{3}}{12} = \frac{12-x}{36}$$

$$X - \frac{5-6x}{15} = \frac{12-x}{36} + \frac{5}{4}$$

$$180x - 12(5-6x) = 5(12-x) + 225$$

$$180x - 60 + 72x = 60 - 5x + 225$$

$$252x - 60 = 285 - 5x$$

$$257x = 345$$

$$x = \frac{345}{257} \text{ or } 1.34$$

2

a

$$2x + 4y - 3z = 120$$

$$5x + 2y + z = 140$$

$$x - 3y + 5z = 100$$

$$x - 3y + 5z = 100$$

$$x = 3y - 5z + 100$$

$$2x + 4y - 3z = 120$$

$$2(3y - 5z + 100) + 4y - 3z = 120$$

$$6y - 10z + 200 + 4y - 3z = 120$$

$$10y - 13z + 200 = 120$$

$$10y - 13z = -80$$

$$5x + 2y + z = 140$$

$$5(3y - 5z + 100) + 2y + z = 140$$

$$15y - 25z + 500 + 2y + z = 140$$

$$17y - 24z + 500 = 140$$

$$17y - 24z = -360$$

$$10y - 13z = -80$$

$$17y - 24z = -360$$

$$170y - 221z = -1360$$

$$170y - 240z = -3600$$

$$(170y - 240z) - (170y - 221z) = -3600 - (-1360)$$

$$-19z = -2240$$

$$z = 117.89$$

$$x + 3y + 5z = 100$$

$$x = 100 - 3y - 5z$$

$$5x + 2y + z = 140$$

$$5x + 2y + 117.89 = 140$$

$$5x + 2y = 22.11$$

$$5x + 22.11 = 2y$$

$$2y = 22.11 - 5x$$

$$22.11 - 5(3y + 5z + 100)$$

$$2y = 22.11 - 15y + 25z + 500$$

$$17y = 22.11 + 25z + 500$$

$$22.11 + 2947.25 + 500$$

$$17y = 2469.36$$

$$y = 145.26$$

$$5x + 2y + z = 140$$

$$5x + (2 \times 145.26) + (117.89) = 140$$

$$290.52 + 117.89$$

$$5x + 408.41 = 140$$

$$5x = -268.41$$

$$x = -53.68$$

3

$$0.6x^2 + 3.4x = 7.4$$

$$6x^2 + 34x - 74 = 0$$

$$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$

$$\frac{-34 \pm \sqrt{34^2 - 4 \cdot 6 \cdot 74}}{2 \cdot 6}$$

$$x = 1.68$$

$$x = -7.36$$

4

a

$$y = 5x^3 - 7x^2 + 3x - 1$$

$$\frac{dy}{dx} = 15x^2 - 14x + 3$$

b

$$y = -\frac{1}{x^5}$$

$$v = -1$$

$$v = x^5$$

$$\frac{dy}{dx} = \frac{x^5(-1) - 1(5x^4)}{(x^5)^2}$$

$$y = -x^{-5}$$

$$\frac{dy}{dx} = -(-5x)^{-6}$$

C $y = e^{\frac{x}{2}} + \cos \frac{x}{2} + \sin 2x$ $\frac{x}{6} = 6^{-1}x$
 $\frac{dy}{dx} = \frac{1}{2}e^{\frac{x}{2}} - \frac{1}{6}\sin(\frac{x}{6}) + 2\cos(2x)$

D $y = (x^7 + 4)^5 (3x^2 - 1)^4$ $\left(\begin{array}{l} \frac{du}{dx} = 35x^6(x^7+4)^4 \\ \frac{dv}{dx} = 24x(3x^2-1)^3 \end{array} \right)$
 $\frac{dy}{dx} = (x^7+4)^5 (24x(3x^2-1)^3) + (3x^2-1)^4 (35x^6(x^7+4)^4)$

E $y = \frac{(5x^2+3x+1)^5}{e^x}$ $\left(\begin{array}{l} \frac{du}{dx} = 5(5x^2+3x+1)^4(10x+3) \\ \frac{dv}{dx} = -e^x \end{array} \right)$
 $\frac{dy}{dx} = \frac{e^x(5(5x^2+3x+1)^4(10x+3)) - (5x^2+3x+1)^5(e^x)}{(e^x)^2}$

F $y = \sqrt{\frac{5x-1}{8x+5}}$ $y^2 = \frac{(5x-1)^2}{(8x+5)^2}$ $\left(\begin{array}{l} \frac{du}{dx} = 10(5x-1) \\ \frac{dv}{dx} = 16(8x+5) \end{array} \right)$
 $\frac{dy}{dx} = \frac{(8x+5)^2(10(5x-1)) - (5x-1)^2(16(8x+5))}{(8x+5)^4}$

G $y = (10x + \sqrt[3]{x^5+1})^5$
 $10 + (\frac{1}{3}(x^5+1)^{-\frac{2}{3}}) \cdot 5x^4$
 $\frac{du}{dx} = 10 + \frac{5x^4}{3(x^5+1)^{2/3}}$ $\frac{dy}{dx} = 5u^4$

$$\frac{dy}{dx} = 5(10x + 3\sqrt{x^5+1})^4 \times (10 + \frac{5x^4}{3(\sqrt{x^5+1})^{2/3}})$$

5

2nd derivative = acceleration - change of velocity over time
 3rd = Jerk - change of acceleration/time
 4th = Snap - change of jerk/time
 5th = Crackle - change of snap/time
 6th = Pop - change of crackle/time

6

a

$$9 \sin x = 2$$

$$\sin x = \frac{2}{9}$$

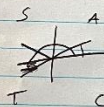
$$x = \sin^{-1}(\frac{2}{9})$$

$$x = 12.84$$

$$x = 12.84$$

$$+ 180 - 12.84$$

$$167.16$$



b

$$5 \sin^2 x - 0.3 \cos x = 2$$

$$5(1 - \cos^2 x) - 0.3 \cos x = 2$$

$$5 - 5 \cos^2 x - 0.3 \cos x = 2$$

$$-5 \cos^2 x - 0.3 \cos x + 3 = 0$$

$$-5y^2 - 0.3y + 3 = 0$$

a b c

$$y = \cos x$$

$$y = \frac{-(-0.3) \pm \sqrt{(-0.3)^2 - 4(-5)(3)}}{2(-5)}$$

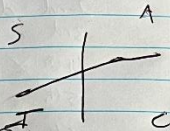
$$y = -0.805$$

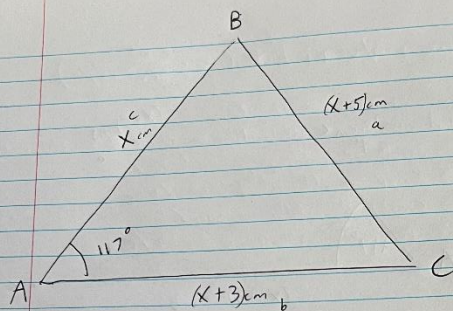
$$y = 0.745$$

~~$$y = -0.805$$~~

$$41.84^\circ \text{ and } 318.16^\circ$$

$$143.61^\circ \text{ and } 216.39^\circ$$





$$a^2 = b^2 + c^2 - 2bc \cos(A)$$

$$(x+5)^2 = (x+3)^2 + x^2 - 2(x+3)(x) \cos(117)$$

$$x^2 + 10x + 25 = (x^2 + 6x + 9) + x^2 - 2(x+3)(x) \cos 117$$

$$-2(x+3)(x) \cos 117 = 2(\cos 117)x^2$$

$$0.908x^2 + 2.724x$$

$$x^2 + 10x + 25 = x^2 + 6x + 9 + x^2 + 0.908x^2 + 2.724x$$

$$x^2 + 4x + 16 = 2x^2$$

$$x^2 + 10x + 25 = 2.908x^2 + 8.724x + 9$$

$$1.909x^2 - 1.724x - 16 = 0$$

$$x = 3.38 \text{ or } x = -2.479$$

$$AB = 3.38 \text{ cm}$$

$$AC = 6.38 \text{ cm}$$

$$BC = 8.38 \text{ cm}$$

$$\frac{1}{2} ab \sin C$$

$$\frac{1}{2} (3.38)(6.38) \sin 117 =$$

$$9.61 \text{ cm}^2$$