

Applied analytics

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Question # 01

(a) Velocity base unit

$$\text{Unit} = \text{m/s} \quad \text{or} \quad \text{ms}^{-1} \text{ (Meters per second)}$$

(b) Momentum

$$\text{base Unit} = \text{Kg m/s} \text{ (kilogram meters per second)}$$

(c) Current

$$\text{base unit} = \text{A (Ampere)}$$

(d) Displacement

$$\text{Base unit} = \text{m (meter)}$$

(e) Energy

$$\text{base unit} = \text{J (Joule)}$$

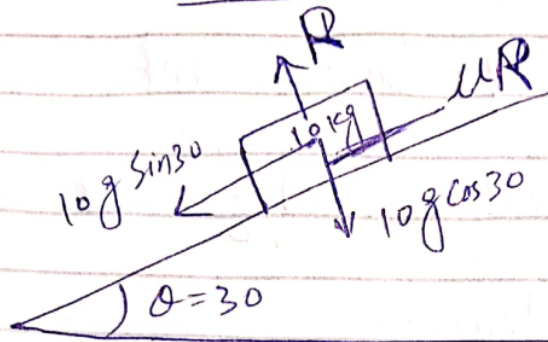
Question # 02

$$F = ma$$

$$\text{Base unit} = \text{N (Newton)}$$

Question #03

(a)



(b)

$$\mu = 0.5$$

$$\begin{aligned} F_r &= \mu N = \mu R \\ &= \mu \times mg \cos 30 \\ &= 0.5 \times 10 \times 9.81 \times \frac{\sqrt{3}}{2} \end{aligned}$$

$$F_r = 24.5\sqrt{3}$$

$$F_r = 42.43 \text{ N}$$

(c) Normal reaction and downward slope reaction or forces will be equal.

(d)

$$R = ?$$

$$R = mg \cos 30$$

$$= 10 \times 9.81 \times \cos 30$$

$$R = 84.96 \text{ N}$$

1

Question # 04

Mass = 2 kg Assume
height = $h = s = 19.6 \text{ m}$, $a = g = 9.81 \text{ m/s}^2$
 $t = ?$
 $v = ?$
 $a_a = ?$

(i)

$$t = ?$$

$$s = \frac{1}{2} at^2$$

$$t^2 = \frac{2s}{a}$$

$$t = \sqrt{\frac{2s}{a}}$$

$$t = \sqrt{\frac{2 \times 19.6}{9.81}}$$

$$t = 2 \text{ sec}$$

(ii)

$$V = ?$$

V is velocity by which object strikes the ground

Using 3rd equation of motion

$$V = u + at$$

$$V = 0 + 9.81 \times 2$$

$$V = 19.62 \text{ m/s}$$

(iii)

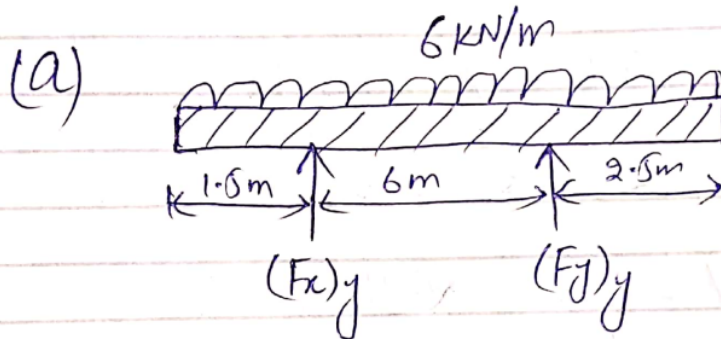
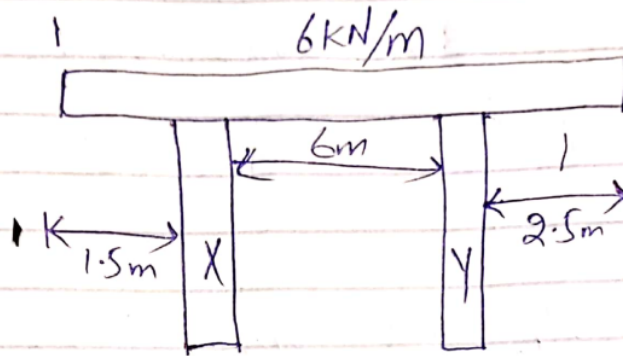
acceleration = $a = ?$

$$a = \frac{V - u}{t}$$

$$= \frac{19.62 - 0}{2}$$

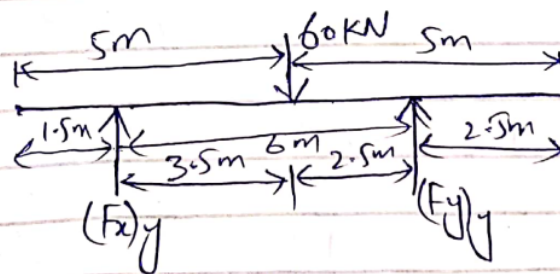
$$a = 9.81 \text{ m/s}^2$$

Question #05



(b)

$$(F_x)_y + (F_y)_y = 60 \rightarrow \textcircled{1}$$



$$\sum M_{(F_x)_y} = 0$$

$$60 \times 3.5 = (F_y)_y \times 6$$

$$\boxed{(F_y)_y = 35 \text{ kN}}$$

put value of $(F_y)_y$ in eq (1)

$$(F_x)_y = 60 - 35$$

$$\boxed{(F_x)_y = 25 \text{ KN}}$$

Question # 06

$$(ii) \quad x^2 + 3x + 2 = 0$$

$$x^2 + \cancel{x} + 2x + 2 = 0$$

$$x(x+1) + 2(x+1) = 0$$

$$(x+2)(x+1) = 0$$

$$\Rightarrow \quad \begin{aligned} x+2 &= 0 \\ x &= -2 \end{aligned}$$

$$\Rightarrow \quad \begin{aligned} x+1 &= 0 \\ x &= -1 \end{aligned}$$

~~Solution~~

Answers

$$\boxed{\begin{aligned} x &= -2 \\ x &= -1 \end{aligned}}$$

$$(ii) \quad x^2 - 7x + 12 = 0$$

$$x^2 - 4x - 3x + 12 = 0$$

$$x(x-4) - 3(x-4) = 0$$

$$(x-4)(x-3) = 0$$

$$x-4 = 0$$

$$\Rightarrow x = 4$$

$$x-3 = 0$$

$$x = 3$$

Answers

$$\boxed{\begin{array}{l} x = 4 \\ x = 3 \end{array}}$$

(iii)

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

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

$$x^2 + 3x + 3x + 9 = 0$$

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

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

$$\Rightarrow x+3 = 0$$

$$\boxed{x = -3} \text{ Answer}$$

(iv)

$$x^2 - 2x - 15 = 0$$

$$x^2 - 5x + 3x - 15 = 0$$

$$x(x-5) + 3(x-5) = 0$$

$$(x-5)(x+3) = 0$$

$$\Rightarrow x-5 = 0$$

$$x = 5$$

$$\Rightarrow x+3 = 0$$

$$x = -3$$

Answers

$$\boxed{\begin{array}{l} x = 5 \\ x = -3 \end{array}}$$

(v)

$$2x^2 + x - 1 = 0$$

$$2x^2 - x + 2x - 1 = 0$$

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

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

$$\Rightarrow 2x-1 = 0$$

$$\boxed{x = \frac{1}{2}}$$

$$\Rightarrow x+1 = 0$$

$$\boxed{x = -1}$$

Question # 07

(i)

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

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

$$a = 1$$

$$b = -1$$

$$c = -1$$

$$x = \frac{-(-1) \pm \sqrt{(-1)^2 - 4(1)(-1)}}{2(1)}$$

$$x = \frac{1 \pm \sqrt{5}}{2}$$

$$\boxed{\begin{array}{l} x = \frac{1 + \sqrt{5}}{2} \\ x = \frac{1 - \sqrt{5}}{2} \end{array}}$$

Answers

(ii)

$$10x^2 + 5x - 4 = 0$$

$$a = 10$$

$$b = 5$$

$$c = -4$$

$$x = \frac{-5 \pm \sqrt{(5)^2 - 4(10)(-4)}}{2(10)}$$

$$x = \frac{-5 \pm \sqrt{185}}{20}$$

$$\boxed{x = \frac{-5 + \sqrt{185}}{20}, \quad x = \frac{-5 - \sqrt{185}}{20}}$$

Question #08

$$(i) \quad \frac{3x}{2} = \frac{x+4}{3}$$

$$(3x)(3) = (x+4)2$$

$$~~3x~~ 9x = 2x + 8$$

$$9x - 2x = 8$$

$$7x = 8$$

$$\boxed{x = 8/7}$$

(ii)

$$3x + 4y = 7 \quad \text{--- (i)}$$

$$2x + y = 3 \quad \text{--- (ii)}$$

Multiply eq(ii) by 4

$$8x + 4y = 12 \quad \text{--- (iii)}$$

$$\underline{\text{eq(iii)} - \text{eq(i)}}$$

$$8x + 4y = 12$$

$$\underline{- 3x + 4y = 7}$$

$$5x = 5$$

$$\boxed{x = 1}$$

Put the value of x in eq (i)

$$3(1) + 4y = 7$$

$$4y = 4$$

$$y = 1$$

$$x = 1$$

$$y = 1$$

FINAL GRADE

86/100

GENERAL COMMENTS

Instructor

Late submission

Q1 Base units 4/5

Joule is not a bases unit.

Q2 0/2

Base units of force are kg/ms^2

Q3 Inclined Planes 9/11

No need to know μ here as in equilibrium forces balance.

Q4 Vertical motion under gravity 5/8

Need to apply Newton's second law in a resistive medium to find acceleration

Q5.Moments 9 /9.

All correct.

Q6 Quadratic equations 14/15

Repeated root $x=-3$ twice!

Q7 Quadratic formula 9/10

If roots are not surds give solution to 2dp's.

Q8. Simultaneous equations 10 /10

All correct.

This is a very nicely completed assignment and shows you have a thorough and sound grasp of the topics involved. Well done!

This is a very good effort well done although 2 months late from the first deadline!

total 60/70

86%

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