

$$1. P = \frac{x+2w}{\sqrt{4x+3R}}$$

$$P^2 = \frac{x+2w}{4x+3R}$$

$$P^2(4x+3R) = x+2w \quad (4x+3R)$$

$$P^2 4x + P^2 3R = x + 2w$$

$$4P^2 x - x = 2w - P^2 3R$$

$$x(4P^2 - 1) = 2w - 3P^2 R$$

$$\frac{(4P^2 - 1)}{4P^2 - 1} \cdot \frac{2w - 3P^2 R}{4P^2 - 1}$$

$$x = \frac{2w - 3P^2 R}{4P^2 - 1}$$

$$2. \frac{8}{4-2\sqrt{3}} \left(\frac{4+2\sqrt{3}}{4+2\sqrt{3}} \right)$$

$$\frac{8 \times 2(2+\sqrt{3})}{16-12}$$

$$16-12$$

$$\frac{16(2+\sqrt{3})}{4}$$

$$8(2+\sqrt{3})$$

$$16+8\sqrt{3}$$

3.

$$P = a + \frac{b}{t^2}$$

$$18 = a + \frac{b}{36}$$

$$216 = 36a + b$$

$$216 = 36a + b$$

$$18 = a + \frac{b}{9}$$

$$162 = 9a + b$$

$$36a + b = 216$$

$$9a + b = 162$$

$$27a = 54$$

$$a = 2$$

$$9a + b = 162$$

$$18 + b = 162$$

$$b = 162 - 18$$

$$b = 144$$

$$P = 2 + \frac{144}{t^2}$$

$$11 = 2 + \frac{144}{t^2}$$

$$9 = \frac{144}{t^2}$$

$$\frac{9t^2}{9} = \frac{144}{9}$$

$$t = \sqrt{\frac{144}{9}} = \pm 4$$

$$= \frac{12}{3} = 4$$

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4. $\log_8(x+6) - \log_8(x-3) = \log_8 8^{\frac{2}{3}}$
 $\log_8 \frac{x+6}{x-3} = \log_8 4$
 $\frac{x+6}{x-3} = 4$
 $x+6 = 4x-12$
 $18 = 3x$
 $6 = x$

$2y^2 + 4y + 3y + 6 = 0$
 $2y(y+2) + 3(y+2) = 0$
 $(2y+3)(y+2) = 0$
 $2y = -3 \quad y = -2$
 $y = \frac{-3}{2}$
 $x = 7 + 2y$
 $x = 7 + 2(-2)$
 $x = 3$
 $x = 7 + 2(\frac{-3}{2})$
 $x = 7 - 3$
 $x = 4$

5. $xR \cdot Px = Qx \cdot xS$
 a) $6x = 4.8x5$
 $x = 4.8x5$
 $x = 40m$

7. $4 - 9x - 3x^2 = 0$
 $2x^2 + x - 36 = 0$
 $S = 1$
 $P = -72$
 $F = 9.8$

b) $QT^2 = PR \cdot RT$
 $QT^2 = 144$
 $QT = \pm 12$
 $+12cm$

$2x^2 + 9x - 8x - 36 = 0$
 $x(2x+9) - 4(2x+9) = 0$
 $(x-4)(2x+9) = 0$
 $x = 4 \quad 2x = -9$
 $x = -4.5$

6. $xy + 6 = 0$
 $x - 2y = 7$
 $x = 7 + 2y$
 $y(7+2y) + 6 = 0$
 $7y + 2y^2 + 6 = 0$
 $2y^2 + 7y + 6 = 0$
 $S = 7$
 $P = 6$
 $F = 4.3$

8. $(1+2x)^7$

1	7	21	35	35
1 ⁷	7 ¹	21 ¹⁵	35 ¹⁴	35 ¹³
$(8x)^0$	$(2x)^1$	$(2x)^2$	$(2x)^3$	

$1 + 7.2x + 21.4x^2 + 35.8x^3$
 $1 + 14x + 84x^2 + 280x^3$

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$$1 + 14x + 84x^2 + 280x^3 + \dots$$

$$(1.02)^7 \rightarrow (1 + 0.02)^7$$

$$= (1 + 2x)^7$$

$$\frac{2x = 0.02}{2} = \frac{0.02}{2}$$

$$x = 0.01$$

$$1 + 14(0.01) + 84(0.01)^2 + 280(0.01)^3$$

$$1 + 0.14 + 0.0084 + 0.0028$$

$$\underline{1.14868}$$

9. $\begin{pmatrix} 3 & 4 \\ y & 6 \end{pmatrix}$

$$18 - 4y = 0$$

$$18 = 4y$$

$$y = \frac{18}{4} = 4.5$$

10. $\begin{pmatrix} 4 & 3 \\ 3 & 5 \end{pmatrix}$

$$20 - 9 = 11$$

$$\frac{1}{11} \begin{pmatrix} 5 & -3 \\ -3 & 4 \end{pmatrix} = \begin{pmatrix} \frac{5}{11} & -\frac{3}{11} \\ -\frac{3}{11} & \frac{4}{11} \end{pmatrix}$$

$$\begin{pmatrix} 4 & 3 \\ 3 & 5 \end{pmatrix} \begin{pmatrix} x \\ y \end{pmatrix} = \begin{pmatrix} 6 \\ 5 \end{pmatrix}$$

$$x = \frac{30 - 15}{11} = \frac{15}{11}$$

$$y = \frac{-18 + 20}{11} = \frac{2}{11}$$

$$A = P \left(1 + \frac{r}{100}\right)^n$$

$$27000 = 24000 \left(1 + \frac{r}{100}\right)^6$$

$$\left(1 + \frac{r}{100}\right)^6 = \frac{27000}{24000}$$

n = 6 months

$$\left(1 + \frac{r}{100}\right)^6 = \sqrt[6]{1.125}$$

$$= 1.02 \text{ to 2 dp}$$

$$\frac{r}{100} = 1.02 - 1$$

$$r = 2\%$$

12. $\frac{1}{4} \times 36000 = 9000$

$$3 \times 36000 = 108000$$

$$5 \times 36000 = 180000$$

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

$$S_{100} = \frac{100}{2}(2 + 99 \times 3)$$

$$= 14950$$

14. $3a + 2b + c = 10$

$$3 \begin{pmatrix} 1 \\ 2 \\ 3 \end{pmatrix} + 2 \begin{pmatrix} 4 \\ -1 \\ 5 \end{pmatrix} + \begin{pmatrix} 1 \\ 0 \\ -5 \end{pmatrix}$$

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14. $\begin{pmatrix} 3 \\ 6 \\ 9 \end{pmatrix} - \begin{pmatrix} 8 \\ -8 \\ 10 \end{pmatrix} + \begin{pmatrix} 1 \\ 0 \\ -5 \end{pmatrix} = \begin{pmatrix} -4 \\ 14 \\ -6 \end{pmatrix}$

15. $\frac{4}{9}$
 $\frac{y}{9}$
 $P(y) = \frac{y}{9}$

16. $y^2 = x^2 + z^2 - 2xz \cos 57.7$
 $y^2 = 13 \cdot 4^2 + 5^2 - 2 \cdot 13 \cdot 4 \cdot 5 \cos 57.7$
 $y^2 = 179.56 + 25 - 134 \cos 57.7$
 $y^2 = 204.56 - 134 \cdot 0.5344$
 $y^2 = 204.56 - 71.6096$
 $y^2 = 132.95$
 $y = \sqrt{132.9504}$
 $y = \pm 11.53$

17.

	-4	-3	-2	-1	0	1	2
x^2	32	18	8	2	0	2	8
$3x$	-12	-9	-6	-3	0	3	6
-5	-5	-5	-5	-5	0	-5	-5
y	15	4	-3	-6	-5	0	9

18. $x = 1$ or $x = -2.5$

$y = 2x^2 + 3x - 5$
 $0 = 2x^2 + 3x - 5$
 $y = 0$ $x = 1$ or $x = -2.5$

$2x^2 + 6x - 2 = y$
 $2x^2 + 3x - 5 = 0$
 $3x + 3 = y$
 $y = 3x + 3$

x	0	1	-1
y	3	6	0

$x = -2$ or 1.9

20. $8x + 12y = 294000$
 $9x + 15y = 337500$
 $4x + 6y = 147000$
 $3x + 5y = 112500$

$\begin{pmatrix} 4 & 6 \\ 3 & 5 \end{pmatrix} \begin{pmatrix} x \\ y \end{pmatrix} = \begin{pmatrix} 147000 \\ 112500 \end{pmatrix}$

$20 - 18 = 2$
 $\frac{1}{2} \begin{pmatrix} 5 & -6 \\ -3 & 4 \end{pmatrix} \begin{pmatrix} 4 & 6 \\ 3 & 5 \end{pmatrix} \begin{pmatrix} x \\ y \end{pmatrix} = \frac{1}{2} \begin{pmatrix} 5 & -6 \\ -3 & 4 \end{pmatrix} \begin{pmatrix} 147000 \\ 112500 \end{pmatrix}$

$\begin{pmatrix} 1 & 0 \\ 0 & 1 \end{pmatrix} \begin{pmatrix} x \\ y \end{pmatrix} = \begin{pmatrix} \frac{5}{2} & -\frac{6}{2} \\ -\frac{3}{2} & \frac{4}{2} \end{pmatrix} \begin{pmatrix} 147000 \\ 112500 \end{pmatrix}$

$367500 - 337500$
 $x = 30000$
 $-220500 + 225000$
 $y = 45000$

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c) 40×3000
 120000
 profit ≈ 12000

45×4500
 2025

$4200 \times 8 + 12 \times 6625$
 $33600 + 78300$
 $= 111900$

ii) $414,300 - 294,000$
 $= 120,300$

ii) $a = 2$

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

$156 = 4(4 + 7d)$

$156 = 16 + 28d$

$\frac{140}{28} = \frac{28d}{28}$

$5 = d$

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

$416 = \frac{n}{2}(4 + (n-1)5)$

$\frac{n(4 + 5n - 5)}{2} = 416$

$\frac{n(5n - 1)}{2} = 416$

$\frac{5n^2 - n}{2} = 416$

$5n^2 - n = 832$

$5n^2 - n - 832 = 0$

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

$\frac{1 \pm \sqrt{1^2 - 4 \times 5 \times -832}}{10}$

10

$\frac{1 \pm \sqrt{16641}}{10}$

10

$\frac{1 + 129}{10}$

10

$\frac{130}{10}$

13

$n = 13$

b) $a + 2d, a + 4d, a + 7d$

a, ar, ar^2

$a + 6, a + 12, a + 21$

$\frac{a + 21}{a + 12} = \frac{a + 12}{a + 6}$

$\frac{a + 21}{a + 12} = \frac{a + 12}{a + 6}$

$a^2 + 6a + 21a + 126 = a^2 + 24a + 144$

$27a + 126 = 24a + 144$

$3a = 18$

$a = 6$

$A = a + 2d$

$= 6 + 6$

$= 12$

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Handwritten mathematical work on lined paper. The left page shows calculations for a geometric series:

$$r = 1.5$$

$$s_n = a(r^n - 1) / (r - 1)$$

$$s_9 = 12(1.5^9 - 1) / (1.5 - 1)$$

$$= 12 \times 37.44 / 0.5$$

$$= 898.56$$

The right page contains a diagram of a triangle with vertices A, B, and C. Side lengths are given as AB = 10, BC = 12, and AC = 15. The angle at vertex C is labeled as 120 degrees. The work includes calculations for the area of the triangle using the formula $\frac{1}{2}ab \sin C$.

At the bottom of the right page, there are several lines of algebraic manipulation involving variables A, B, and C, possibly related to a system of equations or a trigonometric identity.

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22. $\frac{480000}{x}$

$\frac{480000}{x-4} + 20000$

$\frac{480000}{x} = \frac{480000}{x-4} + 20000$

$48000(x-4) = 480000x + 20000(x^2-4x)$

$480000x - 1920000 = 480000x + 20000x^2 - 80000x$

$\frac{20000x^2 - 80000x + 1920000}{1000} = 0$

$20x^2 - 80x + 1920 = 0$

$5x^2 - 20x + 480 = 0$

$x^2 - 4x + 96 = 0$

$\frac{4 \pm \sqrt{4^2 - 4 \times 1 \times 96}}{2}$

$\frac{4 \pm 20}{2}$

$x = \frac{24}{2} = 12$

23. $a^2 = c^2 + b^2 - 2cb \cos 50^\circ$

(a) $a^2 = 8^2 + 6^2 - 2 \times 8 \times 6 \cos 50^\circ$

$= 100 - 96 \cos 50^\circ$

$a^2 = 100 - 96 \times 0.6428$

$a^2 = 100 - 61.7088$

$a^2 = 38.2912$

$a = \sqrt{38.2912}$

$a = 6.188$

b) $\frac{6.188}{\sin 50^\circ} = \frac{6}{\sin x}$

$\sin x = \frac{6 \times \sin 50^\circ}{6.188}$

$\sin x = \frac{6 \times 0.766}{6.188} = 0.74273$

$x = 48.35^\circ$

c) $2.82^2 = 7^2 + 6^2 - 2 \times 7 \times 6 \cos A$

$7.9524 = 49 + 36 - 84 \cos A$

$85 - 84 \cos A$

$\cos A = \frac{85 - 7.9524}{84}$

$\cos A = \frac{77.0476}{84}$

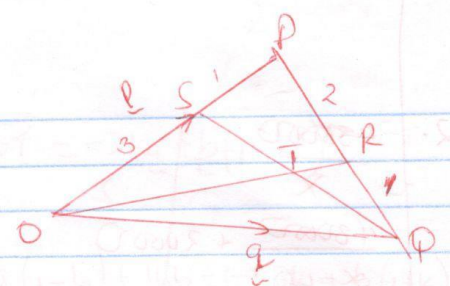
$A = \cos^{-1} \left(\frac{77.0476}{84} \right)$

$A = 23.4^\circ$

22
C

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24 18600
 a) 7800
26400
 $= 26400 \times 12 = 316800$
 $\frac{316800}{20} = 15840$
 b(i) $2280 = 3900$
 $\frac{7800}{3}$
 $\frac{3900}{3}$
 $\frac{11700}{3}$
 $\frac{3900}{4}$
 $\frac{15600}{5}$
 $\frac{3900}{5}$
 $\frac{19500}{5}$
 $\frac{240}{2}$
 $\frac{1680}{5}$
 $\frac{56280}{12}$
 $- 24690$
 (ii) $\frac{4690}{1080}$
3610
 $\frac{26400}{3610}$
5622,790



(i) $\vec{PQ} = \vec{PO} + \vec{OQ}$
 $= -p + q$
 (ii) $\vec{OR} = \vec{OP} + \vec{PR}$
 $= p + 2(-p + q)$
 $= p - 2p + 2q$
 $= -\frac{1}{3}p + \frac{2}{3}q$
 (iii) $\vec{SQ} = \vec{SO} + \vec{OQ}$
 $= -\frac{3}{4}p + q$
 $ST = mSQ$
 $ST = m(-\frac{3}{4}p + q)$
 $ST = -\frac{3m}{4}p + mq$
 $OT = nOR$
 $OT = n(\frac{1}{3}p + \frac{2}{3}q)$
 $= \frac{1}{3}np + \frac{2}{3}nq$
 $\vec{OT} = \vec{OS} + \vec{ST}$
 $OT = \frac{3}{4}p + -\frac{3mp}{4} + mq$

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$$\frac{1}{3}n = \frac{3 + \frac{3}{4}m}{4}$$

$$\frac{1}{3}n = \frac{3 - \frac{3}{4}m}{4}$$

$$\frac{2n}{3} = m$$

$$\frac{2n}{3} = m$$

$$\frac{1}{3}n = \frac{3 - \frac{3}{4} \cdot \frac{2n}{3}}{4}$$

$$2 \times \frac{1}{3}n = \frac{3 \times 2}{4} - \frac{1}{2}n$$

$$4n = 9 - 6n$$

$$\frac{10n}{10} = \frac{9}{10}$$

$$n = \frac{9}{10}$$

$$\frac{2}{3} \cdot \frac{9}{10} = m$$

$$\frac{3}{5} = m$$

$$\underline{\underline{5}}$$

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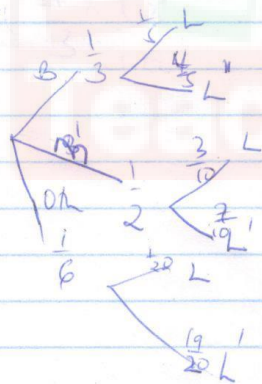
20. The probability that boys goes to school by bus is $\frac{1}{3}$ and by matatu is $\frac{1}{2}$. If he uses a bus the probability that he is late to school is $\frac{1}{5}$ and if he uses a matatu the probability of being late is $\frac{3}{10}$. If he uses other means of transport, the probability of being late is $\frac{1}{20}$. what is the probability that

- a) He will be late to school
- (b) He will not be late to school
- (c) He will be late to school if he does not use a matatu.
- (d) He neither uses a bus nor matatu but arrives to school early.

$$\frac{1}{3} + \frac{1}{2} = \frac{2+3}{6} = \frac{5}{6}$$

20. Answer

a)



$$\left(\frac{1}{3} \times \frac{1}{5}\right) + \left(\frac{1}{2} \times \frac{3}{10}\right) + \left(\frac{1}{6} \times \frac{1}{20}\right)$$

$$\frac{1}{15} + \frac{3}{20} + \frac{1}{120} = \frac{8+18+1}{120}$$

$$= \frac{27}{120}$$

$$= \frac{9}{40}$$

(b) $\left(\frac{1}{3} \times \frac{4}{5}\right) + \left(\frac{1}{2} \times \frac{7}{10}\right) + \left(\frac{1}{6} \times \frac{19}{20}\right) =$

$$\frac{4}{15} + \frac{7}{20} + \frac{19}{120} = \frac{32+42+19}{120} = \frac{93}{120}$$

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$$\begin{aligned} & \textcircled{c} \left(\frac{1 \times 1}{35} \right) + \frac{1 \times 1}{620} \\ &= \frac{1}{15} + \frac{1}{120} \\ &= \frac{8+1}{120} \\ &= \frac{9}{120} \end{aligned}$$

$$\textcircled{d} \frac{1}{6} \times \frac{19}{20} = \frac{19}{120}$$



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