DBE NOV 2023 PAPER 1 MEMOS

ALGEBRA & EQUATIONS & INEQUALITIES [24]

1.1.1

$$x^2 + x - 12 = 0$$
$$\therefore (x+4)(x-3) = 0$$
$$\therefore x + 4 = 0 \quad \text{or} \quad x - 3 = 0$$
$$\therefore \boldsymbol{x = -4} \quad \therefore \boldsymbol{x = 3}$$

1.1.2

$$3x^2 - 2x = 6$$
$$\therefore 3x^2 - 2x - 6 = 0$$
$$\therefore x = \frac{-(-2) \pm \sqrt{(-2)^2 - 4(3)(-6)}}{2(3)} \quad \ldots \quad \boxed{x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}}$$
$$= \frac{2 \pm \sqrt{4+72}}{6}$$
$$\approx \mathbf{1{,}79 \quad or \quad -1{,}12}$$

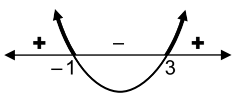
1.1.3

$$\sqrt{2x+1} = x - 1$$
$$\therefore \left(\sqrt{2x+1}\right)^2 = (x-1)^2$$
$$\therefore 2x + 1 = x^2 - 2x + 1$$
$$\therefore 0 = x^2 - 4x$$
$$\therefore x(x-4) = 0$$
$$\therefore x = 0 \quad \text{or} \quad 4$$

Only $x = 4$ ... *For $x = 0$, $\sqrt{\ }$ is neg*

1.1.4

$$x^2 - 3 > 2x$$
$$\therefore x^2 - 2x - 3 > 0$$
$$\therefore (x-3)(x+1) > \mathbf{0}$$
$$\therefore \boldsymbol{x < -1 \quad or \quad x > 3}$$



1.2

$$x + 2 = 2y$$
$$\therefore x = 2y - 2 \quad \ldots ❶$$
$$\frac{1}{x} + \frac{1}{y} = 1$$
$$(\times xy) \quad \therefore y + x = xy \quad \ldots ❷$$

❶ in ❷:
$$\therefore y + (2y - 2) = y(2y-2)$$
$$\therefore 3y - 2 = 2y^2 - 2y$$
$$\therefore 0 = 2y^2 - 5y + 2$$
$$\therefore (2y-1)(y-2) = 0$$
$$\therefore y = \frac{1}{2} \quad \text{or} \quad y = 2$$

For $y = \frac{1}{2}$: $x = 2\left(\frac{1}{2}\right) - 2 = -1$

& For $y = 2$: $x = 2(2) - 2 = 2$

$\therefore$ Solution: $\left(\mathbf{-1; \frac{1}{2}}\right)$ **or (2; 2)**

OR:

$$x + 2 = 2y$$
$$\therefore x = 2y - 2 \quad \ldots ❶$$
$$\frac{1}{x} + \frac{1}{y} = 1 \quad \ldots ❷$$

❶ in ❷:
$$\therefore \frac{1}{2y-2} + \frac{1}{y} = 1 \quad \times y(2y-2)$$
$$\therefore y + 2y - 2 = y(2y-2)$$
$$\therefore y + 2y - 2 = 2y^2 - 2y$$
$$\therefore 2y^2 - 5y + 2 = 0$$
$$\therefore (2y-1)(y-2) = 0$$
$$\therefore y = \frac{1}{2} \quad \text{or} \quad y = 2$$
$$\therefore x = -1 \quad \text{or} \quad x = 2$$
$$\therefore \left(\mathbf{-1; \frac{1}{2}}\right) \quad \textbf{or} \quad \mathbf{(2; 2)}$$

1.3

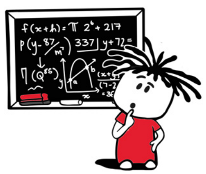
$$2^{m+1} + 2^m = 3^{n+2} - 3^n$$
$$\therefore 2^m.2 + 2^m = 3^n.3^2 - 3^n$$
$$\therefore 2^m(2+1) = 3^n(3^2 - 1)$$
$$\therefore 3.2^m = 8.3^n$$
$$(\div 3.8) \quad \frac{2^m}{8} = \frac{3^n}{3}$$
$$\therefore \frac{2^m}{2^3} = \frac{3^n}{3}$$
$$\therefore 2^{m-3} = 3^{n-1}$$

only possible if $m - 3 = 0$ and $n - 1 = 0$

$\therefore m = 3 \quad \therefore n = 1$

$\therefore$ **m + n = 4**

OR:
$$2^m(2+1) = 3^n(3^2 - 1)$$
$$\therefore 2^m.3 = 3^n.8$$
$$\frac{2^m}{3^n} = \frac{8}{3}$$
$$\therefore \frac{2^m}{3^n} = \frac{2^3}{3}$$
$$\therefore m = 3 \text{ and } n = 1$$
$$\therefore \mathbf{m + n = 4}$$



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PATTERNS & SEQUENCES [26]

2.1 **A.S.**: 7 + 12 + 17 + . . .

2.1.1 **a** = 7 ; **d** = 5 ; **T_{91}?** ; **n** = 91

$$\mathbf{T_n = a + (n - 1)d}$$

$\therefore\ T_{91} = 7 + (91 - 1)(5)$

$= \mathbf{457}$ ◄

OR: General term, $\mathbf{T_n = an + b}$

where $\mathbf{a} = 5$ and $\mathbf{b} = 2$

$\therefore\ T_{91} = 5(91) + 2$

$= \mathbf{457}$ ◄

2.1.2 $\mathbf{S_n = \frac{n}{2}(a + T_n)}$

$\therefore\ S_{91} = \frac{91}{2}(7 + T_{91})$

$= \frac{91}{2}(7 + 457)$

$= \mathbf{21\ 112}$ ◄

OR: $\mathbf{S_n = \frac{n}{2}\left[2a + (n - 1)d\right]}$

$\therefore\ S_{91} = \frac{91}{2}\left[2(7) + (91 - 1)(5)\right]$

$= \mathbf{21\ 112}$ ◄

2.1.3 **n?** ; $\mathbf{T_n} = 517$

$\mathbf{T_n = a + (n - 1)d}$ ➔ $517 = 7 + (n - 1)(5)$

$\therefore\ 517 = 7 + 5n - 5$

$\therefore\ 515 = 5n$

$\therefore\ \mathbf{n = 103}$ ◄

OR: $\mathbf{T_n = an + b}$

$\therefore\ 517 = 5n + 2$

$\therefore\ 515 = 5n$

$\therefore\ \mathbf{n = 103}$ ◄

2.2.1 General form: $\mathbf{T_n = an^2 + bn + c}$

$T_1 = 3$; $T_2 - T_1 = 9$ and $T_3 - T_2 = 21$

∴ The pattern:	3		12		33		66		111
1st differences:		9		21		33		45	
2nd differences:			12		12		12		

$\mathbf{T_5 = 66 + 45 = 111}$ ◄

2.2.2 $T_1 = a + b + c = 3$

$\mathbf{2a} = 12$ . . . *Common 2nd difference*

$\therefore\ \mathbf{a} = 6$

& $\mathbf{3a + b} = 9$ . . . *The first 1st difference*

$\therefore\ 18 + b = 9$

$\therefore\ \mathbf{b} = -9$

$\therefore\ 6 + (-9) + c = 3$

$\therefore\ \mathbf{c} = 6$

$\therefore\ \mathbf{T_n = 6n^2 - 9n + 6}$ ◄

2.2.3 $\frac{dT_n}{dn} = 12n - 9$

If $n > \frac{3}{4}$ $\quad 12n - 9 > 0$

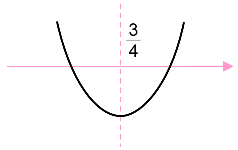
Since $n \in \mathbb{N}$ the derivative will always be positive

$\therefore$ **T_n is always increasing for all $n \in \mathbb{N}$** ◄

OR: $T_n = 6n^2 - 9n + 6$

A of S: $n = -\frac{-9}{2(6)}$

$= \frac{3}{4}$



$\therefore$ **T_n is always increasing for all $n \in \mathbb{N}$** ◄

OR:

$\mathbf{T_{n+1} - T_n} = 6(n + 1)^2 - 9(n + 1) + 6 - (6n^2 - 9n + 6)$

$= 6(n^2 + 2n + 1) - 9n - 9 + 6 - 6n^2 + 9n - 6$

$= 6n^2 + 12n + 6 - 9 - 6n^2$

$= 12n - 3$

Since $n \geq 1$ and a whole number

. . . *since n = the number of terms*

$12n - 3$ has a minimum value of $12(1) - 3 = 9$, which is positive

$\therefore$ **The difference between consecutive terms T_n and T_{n+1} will always be positive.**

$\therefore$ The pattern is increasing for all $n \in \mathbb{N}$ ◄

3.1 **G.S.:** 3 + 6 + 12 + . . . to n terms

3.1.1 **a** = 3 ; **r** = 2

$T_n = ar^{n-1}$ ➡ $T_n = 3.2^{n-1}$ ◀

3.1.2 $\sum_{p=1}^{k} \frac{3}{2}(2)^p = 98\,301$ . . . *i.e.* $\mathbf{S_k} = 98\,301$

$$\text{LHS} = \frac{3}{2}(2)^1 + \frac{3}{2}(2)^2 + \frac{3}{2}(2)^3 + \ldots + \frac{3}{2}(2)^k$$

$$= 3 + 6 + 12 + \ldots + \frac{3}{2}(2)^k$$

Sum, $\mathbf{S_n}$, of a G.S. with **a** = 3 ; **r** = 2 ; **n** = k

$$S_n = \frac{\mathbf{a(r^n - 1)}}{\mathbf{r - 1}}$$

$$S_k = \frac{3(2^k - 1)}{2 - 1}$$

$$= 3(2^k - 1)$$

$\therefore 3(2^k - 1) = 98\,301$

$\therefore 2^k - 1 = 32\,767$

$\therefore 2^k = 32\,768$

$\therefore k = \log_2 32\,768$ . . . *OR, by inspection*

$\therefore$ **k = 15** ◀

3.2

	Arithmetic Sequence	Geometric Sequence
1^{st} term:	$\mathbf{T_1} = x$	$\mathbf{T_1} = x$
	$\mathbf{d} = 3$	$\mathbf{r} = \frac{1}{3}$

Arithmetic Sequence:

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

$$S_{22} = \frac{22}{2}[2x + (22 - 1)(3)]$$

$$= 11(2x + 63)$$

$$= 22x + 693$$

Geometric Sequence:

$$\mathbf{S_\infty} = \frac{\mathbf{a}}{\mathbf{1 - r}}$$

$$= \frac{x}{1 - \frac{1}{3}}$$

$$= \frac{3x}{3 - 1}$$

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

$\mathbf{S_{22}}$ of the A.S. = S_∞ of the G.S. + 734

$\therefore 22x + 693 = \frac{3x}{2} + 734$

$(\times 2)$ $\therefore 44x + 1\,386 = 3x + 1\,468$

$\therefore 41x = 82$

$\therefore x = 2$

i.e. $T_1 = 2$ ◀

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NOTES

FUNCTIONS & GRAPHS [32]

4.1 $y = -4$ ◄

4.2 At B, $y = 0$

$\therefore\ 2^x - 4 = 0$

$\therefore\ 2^x = 4$

$\therefore\ x = 2$

$\therefore$ **B(2; 0)** ◄

4.3 y-intercept of f:

$f(0) = 2^0 - 4 = 1 - 4 = -3$

$\therefore$ A(0; –3)

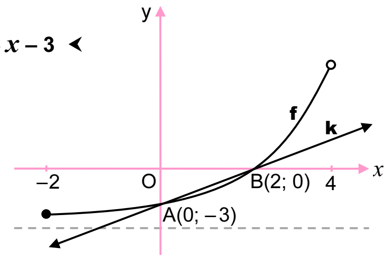
$\therefore$ y-intercept of k, $c = -3$

Gradient, $m = \frac{3}{2}$ . . . *by inspection*

(or: $m_{AB} = \frac{0-(-3)}{2-0} = \frac{3}{2}$)

$\therefore$ Eqn of k: $y = \frac{3}{2}x - 3$

i.e. $\mathbf{k(x) = \frac{3}{2}x - 3}$ ◄



4.4 The vertical distance $= k(x) - f(x)$

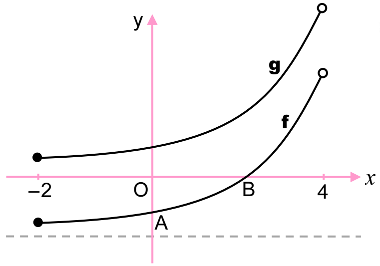
$= k(1) - f(1)$

$= -\frac{3}{2} - (-2)$ . . . $k(1) = \frac{3}{2}(1) - 3$ & $f(1) = 2^1 - 4$

$= \frac{1}{2}$ **unit** ◄

4.5 $g(x) = 2^x - 4 + 4$

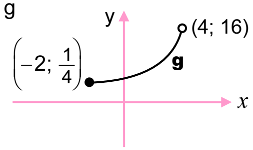
$\therefore\ \mathbf{g(x) = 2^x}$ ◄ for $x \in [-2; 4)$



4.6 The domain of g^{-1} = the range of g

range of g: $\frac{1}{4} \leq y < 16$

$\therefore$ domain of g^{-1}: $\mathbf{\frac{1}{4} \leq x < 16}$ ◄



4.7 $\mathbf{y = \log_2 x}$ **for** $x \in \left[\frac{1}{4}; 16\right)$ ◄

NOTES

5.1 Turning point of f: **B(1; 8)** ◄

5.2 At C, $x = 0$

& $f(0) = -\frac{1}{2}(0-1)^2 + 8 = 7\frac{1}{2}$

$\therefore$ **C$\left(0; 7\frac{1}{2}\right)$** ◄

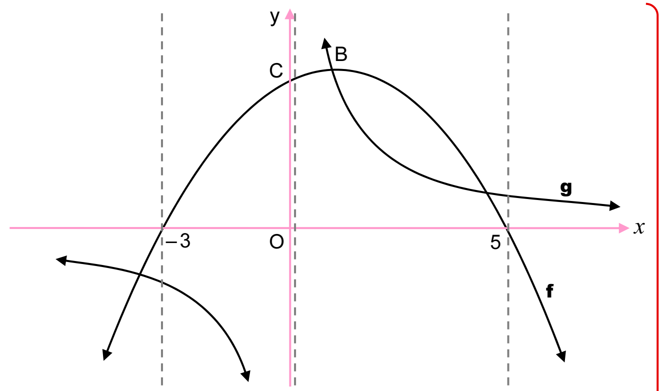
5.3 B(1; 8) a point on g

➡ $g(1) = \frac{d}{1} = 8$ . . . $g(x) = \frac{d}{x}$

$\therefore$ **d = 8** ◄

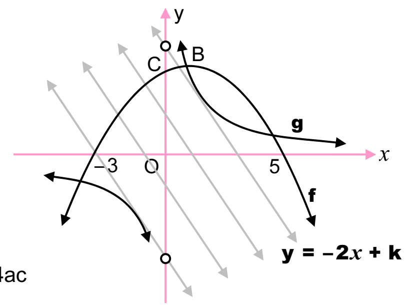
5.4 **$y \in \mathbb{R}$; $y \neq 0$** ◄

5.5 **$-3 \leq x < 0$ or $x \geq 5$** ◄



f(x):	f(x) < 0	f(x) > 0	f(x) > 0	f(x) < 0
g(x):	g(x) < 0	g(x) < 0	g(x) > 0	g(x) > 0
f(x).g(x):	+ve	–ve	+ve	–ve

5.6 At any point(s) of intersection:



$h(x) = g(x)$

$\therefore -2x + k = \frac{8}{x}$

$(\times x)$ $\therefore -2x^2 + kx = 8$

$\times(-1)$ $\therefore 2x^2 - kx + 8 = 0$

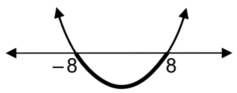
$\Delta = (-k)^2 - 4(2)(8)$ $\Delta = b^2 - 4ac$

$= k^2 - 64$

There will be no points of intersection if $\Delta < 0$

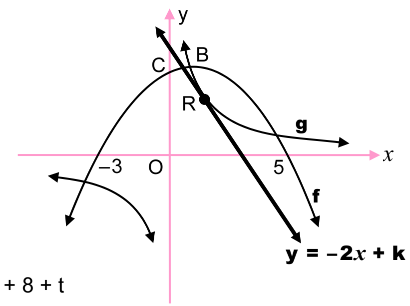
$k^2 - 64 < 0$

$\therefore (k+8)(k-8) < 0$



$\therefore$ **$-8 < k < 8$** ◄

5.7 $g'(x) = -\frac{8}{x^2}$



$\therefore -\frac{8}{x^2} = -2$

$\therefore x^2 = 4$

$\therefore x = \pm 2$

$\therefore$ R(2; 4)

$y = -\frac{1}{2}(x-1)^2 + 8 + t$

$\therefore 4 = -\frac{1}{2}(2-1)^2 + 8 + t$

$\therefore 4 = -\frac{1}{2} + 8 + t$

$\therefore$ **$t = -3\frac{1}{2}$** ◄

FINANCE, GROWTH & DECAY [16]

6.1 **P** = R18 500 ; **i** = $\frac{r}{12}$% ; **n** = 6 ; **A** = 19 319,48

6.1.1 $\mathbf{A = P(1 + r)^n}$ ➡ $19\,319{,}48 = 18\,500\left(1 + \frac{i}{12}\right)^6$

$$\therefore \left(1 + \frac{i}{12}\right)^6 = \frac{19\,319{,}48}{18\,500}$$

$$= 1{,}04429....$$

$$\therefore 1 + \frac{i}{12} = \sqrt[6]{1{,}04429....}$$

$$= 1{,}00725....$$

$$\therefore \frac{i}{12} = 0{,}00725$$

$$\therefore i \simeq 0{,}087$$

$$\therefore \mathbf{r \simeq 8{,}70\%} \;\blacktriangleleft$$

6.1.2 $\mathbf{1 + i_{eff} = \left(1 + \frac{i_{nom}}{m}\right)^m}$

$$\therefore 1 + i_{eff} = \left(1 + \frac{0{,}087}{12}\right)^{12}$$

$$\therefore 1 + i_{eff} = 1{,}09055\ldots$$

$$\therefore \mathbf{i_{eff}} = 0{,}09055\ldots$$

$$\simeq \mathbf{9{,}06\%} \;\blacktriangleleft$$

6.2.1 The value of the laptop decreasing to R0:

P = R10 000 ; **n?** ; **i** = 0,2 ; **A** = R0

$\mathbf{A = P(1 - in)}$ ➡ $0 = 10\,000(1 - 0{,}2n)$

$$\therefore 0 = 1 - 0{,}2n$$

$$\therefore 0{,}2n = 1$$

$$\therefore n = \frac{1}{0{,}2}$$

$$\therefore \mathbf{n = 5\ years} \;\blacktriangleleft$$

6.2.2 New laptop:

$\mathbf{F_v}$ = R20 000 ; **n** = 60 ; **i** = $\frac{8{,}7\%}{12} = \frac{0{,}087}{12}$

$$\mathbf{F_v} = \frac{x\left[(\mathbf{1+i})^{\mathbf{n}} - \mathbf{1}\right]}{\mathbf{i}} \;\Rightarrow\; 20\,000 = \frac{x\left[\left(1 + \frac{0{,}087}{12}\right)^{60} - 1\right]}{\frac{0{,}087}{12}}$$

$$\therefore x = 267{,}2611\ldots$$

$\therefore \boldsymbol{x} = \mathbf{R267{,}27}$ ◀ . . . *R267,26 will give a value just short of R20 000*

6.3 $\mathbf{P_v}$ = R1 600 000 ; **i** = $\frac{11{,}2}{12}$% ; $\boldsymbol{x}$ = 20 000 ; **n?**

$$\mathbf{P_v} = \frac{x\left[\mathbf{1 - (1+i)^{-n}}\right]}{\mathbf{i}}$$

$$\therefore 1\,600\,000 = \frac{20\,000\left[1 - \left(1 + \frac{11{,}2\%}{12}\right)^{-n}\right]}{\frac{11{,}2\%}{12}}$$

$$\therefore 80 = \frac{\left[1 - \left(1 + \frac{0{,}112}{12}\right)^{-n}\right]}{\frac{0{,}112}{12}}$$

$$\left(\times \frac{0{,}112}{12}\right) \quad \therefore \frac{56}{75} = 1 - \left(1 + \frac{0{,}112}{12}\right)^{-n}$$

$$\therefore \left(1 + \frac{0{,}112}{12}\right)^{-n} = 1 - \frac{56}{75}$$

$$\therefore -n = \log_{\left(1 + \frac{0{,}112}{12}\right)} \frac{19}{75}$$

$$= -147{,}79\ldots$$

$$\therefore \mathbf{n} = 147{,}79\ldots$$

∴ **He can make 147 withdrawals of R20 000** ◀

DIFFERENTIAL CALCULUS [37]

7.1

$$f(x) = -4x^2$$
$$\therefore\ f(x+h) = -4(x+h)^2$$
$$= -4(x^2 + 2xh + h^2)$$
$$= -4x^2 - 8xh - 4h^2$$
$$\therefore\ f(x+h) - f(x) = -8xh - 4h^2$$
$$\therefore\ \frac{f(x+h) - f(x)}{h} = -8x - 4h$$
$$\therefore\ f'(x) = \lim_{h \to 0} \frac{f(x+h) - f(x)}{h}$$

def of a derivative

$$= \lim_{h \to 0} (-8x - 4h)$$
$$= \mathbf{-8x}\ \blacktriangleleft$$

OR: $f'(x) = \lim_{h \to 0} \frac{-4(x+h)^2 - (-4x^2)}{h}$

$$= \lim_{h \to 0} \frac{-4x^2 - 8xh - 4h^2 + 4x^2}{h}$$
$$= \lim_{h \to 0} \frac{-8xh - 4h^2}{h}$$
$$= \lim_{h \to 0} (-8x - 4h)$$
$$= -8x$$

7.2.1 $f(x) = 2x^3 - 3x$

$$\therefore\ \mathbf{f'(x) = 6x^2 - 3}\ \blacktriangleleft$$

7.2.2 $D_x\left(7 \cdot x^{\frac{2}{3}} + 2x^{-5}\right)$

$$= 7 \cdot \frac{2}{3} x^{-\frac{1}{3}} + 2 \cdot -5x^{-6}$$
$$= \frac{14}{3} \cdot x^{-\frac{1}{3}} - 10x^{-6}\ \blacktriangleleft$$
$$= \frac{14}{3x^{\frac{1}{3}}} - \frac{10}{x^6}\ \blacktriangleleft$$
$$= \frac{14}{3\sqrt[3]{x}} - \frac{10}{x^6}\ \blacktriangleleft$$

7.3

The tangent to a graph:
The gradient of the tangent to a graph f is the derivative, $f'(x)$

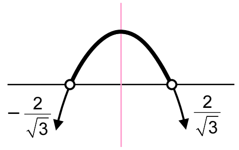
$$f(x) = -2x^3 + 8x$$
$$\therefore\ \text{The gradient of the tangent} = f'(x) = -6x^2 + 8$$

$f'(x) > 0 \Rightarrow -6x^2 + 8 > 0$

The graph of $y = f'(x)$:

The roots: $-6x^2 + 8 = 0$

$$\therefore\ 6x^2 - 8 = 0$$
$$\therefore\ 6x^2 = 8$$
$$\therefore\ x^2 = \frac{4}{3}$$
$$\therefore\ x = \pm \frac{2}{\sqrt{3}}$$



$$\therefore\ \mathbf{-\frac{2}{\sqrt{3}} < x < \frac{2}{\sqrt{3}}}\ \blacktriangleleft$$

or $\mathbf{-1{,}15 < x < 1{,}15}\ \blacktriangleleft$

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NOTES

8.1 $f(x) = -x^3 + 6x^2 - 9x + 4 = (x-1)^2(-x+4)$

At the turning points, $\mathbf{f'(x) = 0}$

$\therefore\ f'(x) = -3x^2 + 12x - 9 = 0$

$\div(-3):\quad \therefore\ x^2 - 4x + 3 = 0$

$\therefore\ (x-1)(x-3) = 0$

$\therefore\ x = 1 \text{ or } 3$

$f(1) = (1-1)^2(-1+4)$
$= 0$

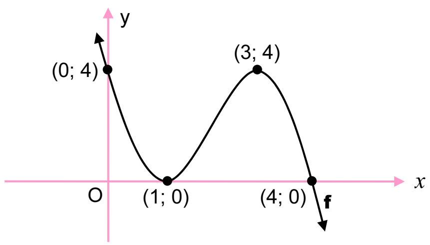
& $f(3) = (3-1)^2(-3+4)$
$= 4$

$\therefore$ **Turning points are (1; 0) and (3; 4)** ◄

8.2 **Y-intercept:** $f(0) = 4$
(x = 0) $\therefore$ (0; 4)

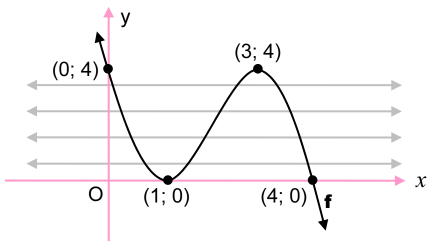
X-intercepts: $(x-1)^2(-x+4) = 0$
(y = 0) $\therefore\ x = 1$ ('twice': this is also a t.pt)
or $x = 4$

$\therefore$ (1; 0) and (4; 0)



8.3 **0 < k < 4** ◄

y = k could be (the eqn of) any of these **grey** lines. They all cut f at 3 distinct points.



8.4 At the point of inflection: $f''(x) = 0$

$\therefore\ f''(x) = -6x + 12 = 0$

$\therefore\ -6x = -12$

$\therefore\ x = 2$

$f(2) = 2$

$\therefore$ **The point of inflection is (2; 2)** ◄

The gradient of the tangent to f,

$a = f'(2) = -3(2)^2 + 12(2) - 9$
$= -12 + 24 - 9$
$= 3$

Substitute a = 3 and (2; 2) in $y = ax + b$:

$\therefore\ 2 = (3)(2) + b$
$\therefore\ b = -4$

(or $y - y_1 = m(x - x_1)$ $\therefore\ y - 2 = 3(x - 2)$, etc.)

$\therefore$ The eqn of g: $\mathbf{y = 3x - 4}$ ◄

8.5 $\tan\theta = 3$ . . . *the gradient of g*

$\therefore\ \theta = \mathbf{71{,}57^\circ}$ ◄

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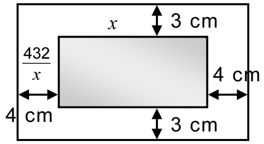
NOTES

9.1 The area of rectangle ABCD:

$x \times AB = 432\ \text{cm}^2$

$\therefore\ AB = \frac{432}{x}\ \text{cm}$



$\therefore$ The total area $= (x + 8)\left(\frac{432}{x} + 6\right)$

$= 432 + 6x + \frac{3\,456}{x} + 48$

$= \mathbf{\frac{3\,456}{x} + 6x + 480}$ ✓

9.2 The total area, $A = 3\,456x^{-1} + 6x + 480$

For minimum value, $\frac{dA}{dx} = 0$

$\therefore\ -3\,456x^{-2} + 6 = 0$

$\therefore\ -\frac{3\,456}{x^2} = -6$

$\times(-x^2)\quad \therefore\ 3\,456 = 6x^2$

$(\div 6)\quad \therefore\ 576 = x^2$

$\therefore\ \boldsymbol{x} = \mathbf{24\ cm}\quad \ldots\ x > 0$ ✓

NOTES

PROBABILITY [15]

10.1.1 For independent events, A and B:

$P(\text{A and B}) = P(A) \times P(B)$

$= \frac{1}{3} \times \frac{3}{4}$

$= \mathbf{\frac{1}{4}}$ ✓

10.1.2 P(at least ONE event occurs)

$= P(\text{A or B})$

$= P(A) + P(B) - P(\text{A and B})$

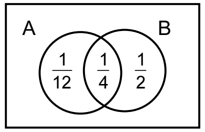
$= \frac{1}{3} + \frac{3}{4} - \frac{1}{4}$

$= \mathbf{\frac{5}{6}}$ ✓

OR: P(at least ONE event occurs)

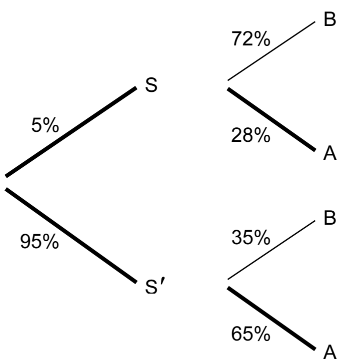
$= \frac{1}{12} + \frac{1}{4} + \frac{1}{2}$

$= \mathbf{\frac{5}{6}}$ ✓



10.2.1

Temperature
B: below 0ºC
A: above 0ºC



10.2.2 $P(A) = P(\text{S and A}) + P(\text{S}' \text{and A})$

$= 5\% \times 28\% + 95\% \times 65\%$

$= 1{,}4\% + 61{,}75\%$

$= \mathbf{63{,}15\%}$ ✓

10.3.1 No. of ways: 10 9 8 7 6 5 4 3 2 1

$\therefore$ 10! = **3 628 800** ✓

10.3.2 The youngest learners with 5 learners in between.

2 8 7 6 5 4 1

Think of the two youngest learners and 5 learners in between as one unit. So arrange 4 "groups", i.e. 4!

no. of ways $= 4! \times (2 \times 8 \times 7 \times 6 \times 5 \times 4 \times 1)$

$= 322\ 560$

$\therefore$ PROBABILITY $= \frac{322\ 560}{3\ 628\ 800}$ . . . $P(E) = \frac{n(E)}{n(S)}$

$= \mathbf{\frac{4}{45}}$ ✓

OR:

(2) × 8 × 7 × 6 × 5 × 4 × (1) × 3 × 2 × 1

8 × (2) × 7 × 6 × 5 × 4 × 3 × (1) × 2 × 1

8 × 7 × (2) × 6 × 5 × 4 × 3 × 2 × (1) × 1

8 × 7 × 6 × (2) × 5 × 4 × 3 × 2 × 1 × (1)

$\therefore$ PROBABILITY $= \frac{4 \times 2 \times 8!}{10!}$ . . . $P(E) = \frac{n(E)}{n(S)}$

$= \mathbf{\frac{4}{45}}$ ✓

OR:

P(either younger learner) $= \frac{2}{10}$

P(second younger learner) $= \frac{1}{9}$

Younger learners could be in positions 1 and 7, or 2 and 8, or 3 and 9, or 4 and 10.

$\therefore$ PROBABILITY $= \frac{2}{10} \times \frac{1}{9} \times 4$

$= \mathbf{\frac{4}{45}}$ ✓

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