SECTION A

Question 1

1.1 Solve for x in each of the following. Show all relevant working detail.

a) $x^2 - 1 = x$ (Round off to two decimal places) (4)

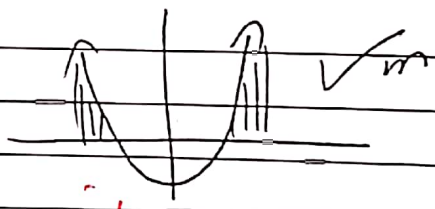
$x^2 - x - 1 = 0$ ✓a

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

$x = 1,62$ ✓ca or $x = -0,62$ ✓ca

b) $2x^2 - x - 6 > 0$ (4)

$(x-2)(2x+3) > 0$ ✓a



✓m

$x < -\frac{3}{2}$ ✓ca or $x > 2$ ✓ca

Rewrite $-\frac{3}{2} > x > 2$ or $2 < x < -\frac{3}{2}$ 3/4

1.2 Simplify the following without a calculator:

a) $\sqrt{9x^4 + 16x^4}$ (2)

$= \sqrt{25x^4}$ ✓a

$= 5x^2$ ✓ca

b) $\left(\frac{b^{-\frac{1}{3}}}{\sqrt[3]{b^2}}\right)^{-2}$ (4)

$= \frac{b^{\frac{2}{3}}}{\left(b^{\frac{3}{3}}\right)^{-2}}$ ✓m ✓a

$= b^{\frac{2}{3}-\left(\frac{-4}{3}\right)}$ ✓a

$= b^2$ ✓cq

c) $\frac{9^{n-1}.27^{3-2n}}{81^{2-n}}$ (4)

$= \frac{\left(3^2\right)^{n-1} \cdot \left(3^3\right)^{3-2n}}{\left(3^4\right)^{2-n}}$ ✓m

$= \frac{3^{2n-2} \cdot 3^{9-6n}}{3^{8-4n}}$ ✓a

$= 3^{2n-2+9-6n-(8-4n)}$ ✓cq

$= \frac{1}{3}$ ✓cq

d) $\frac{2^{x+2}-3.2^{x+1}}{2^{x-1}}$ (4)

$= \frac{2^x.2^2 - 3.2^x.2}{2^x.2^{-1}}$ ✓m

$= \frac{2^x(2^2-3.2)}{2^x.2^{-1}}$ ✓a

$= \frac{4-6}{\frac{1}{2}}$ ✓a

$= -4$ ✓cq

e) $\frac{pq^{-1}-p^{-1}q}{q^{-1}-p^{-1}}$ (5)

$= \frac{\frac{p}{q}-\frac{q}{p}}{\frac{1}{q}-\frac{1}{p}}$ ✓m

$= \frac{p^2-q^2}{qp} \div \frac{p-q}{pq}$ ✓a ✓a

$= \frac{(p-q)(p+q)}{qp} \times \frac{pq}{p-q}$ ✓q

$= p+q$ ✓cq

1.3 Solve for both x and y in the system of equations below.

$2y + x = 1$ and $y = 3x^2 - x - 3$ (6)

$x = 1 - 2y$ ✓a

$y = 3(1-2y)^2 - (1-2y) - 3$ ✓m

$y = 3(1 - 4y + 4y^2) - 1 + 2y - 3$ ✓ca

$0 = 12y^2 - 11y - 1$ ✓ca

$0 = (y-1)(12y+1)$

$y = 1$ or $y = -\frac{1}{12}$ ✓ca

$x = 1 - 2(1)$ ✓m $\quad x = 1 - 2(-\frac{1}{12})$

$= -1 \quad x = \frac{7}{6}$ ✓a

$2y = 1 - x$

$y = \frac{1-x}{2}$

$\frac{1-x}{2} = 3x^2 - x - 3$

$1 - x = 6x^2 - 2x - 6$

$6x^2 - x - 7$

$(6x-7)(x+1)$

$x = \frac{7}{6}$ or -1

[33]

Question 2

8; 24; 72; ……

a) Write down the next 3 terms of the sequence. (3)

216; 648; 1944. ✓a

b) Find the general term. (2)

$T_n = 8 \cdot 3^{n-1}$ ✓a ✓a

cf 24^{n-1} taken as 1/0. v ignored

c) Show by calculation whether 5832 is a term of this sequence or not. (3)

$5832 = 8 \cdot 3^{n-1}$ ✓a

$729 = 3^{n-1}$ ✓ca

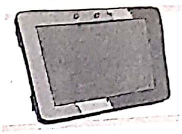
$3^6 = 3^{n-1}$

$6 = n - 1$

$7 = n$ ✓ca

[8]

Question 3



After just 2 years, a tablet is worth one third of its original value. Assuming reducing balance depreciation, what was the annual rate of depreciation?

$\frac{x}{3} = x(1-i)^2$ ✓a

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

$(\frac{1}{3})^{\frac{1}{2}} = 1 - i$ ✓ca

$(\frac{1}{3})^{\frac{1}{2}} - 1 = -i$ ✓ca

$42,3\% = i$ ✓ca

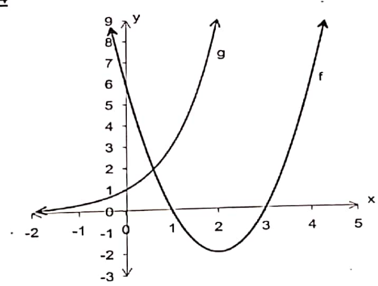
cf used $\frac{1}{3} = 1(1-2i)$

$i = 33,33\%$

Max 2/4

[4]

Question 4



a) Which function, f or g, has the equation $y = a^x$? (1)

$g(x)$ ✓a

b) What is the range of g(x) ? (1)

$y > 0$ ✓a

c) Give the equation of the asymptote of g(x). (1)

$y = 0$ ✓a

d) Give the equation of the axis of symmetry of f(x) (1)

$x = 2$ ✓a

e) For what values of x is f(x) increasing? (1)

$x > 2$ ✓a

f) For what values of x will g(x).f(x) < 0? (2)

$1 < x < 3$

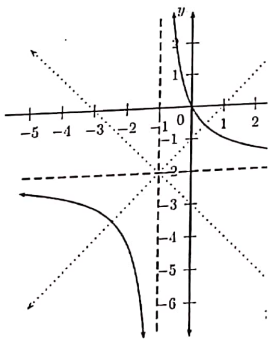
✓a ✓a

[7]

Question 5

Calculate the values of a - g in each of the equations below:

$y = \frac{a}{x-b} + c$ (4)



$y = \frac{a}{x+1} - 2$ ✓

$0 = \frac{a}{0+1} - 2$ ✓m

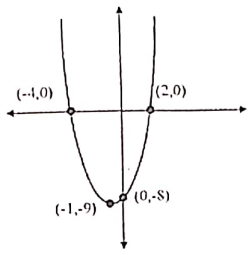
$2 = a$ ✓ca

$b = -1$ ✓a

Gave credit for eqn

$y = \frac{2}{x+1} - 2$

$dx^2 + ex + f = 0$ (5)



$y = a(x+4)(x-2)$ ✓a

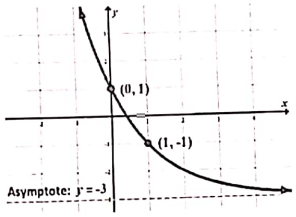
$-8 = a(0+4)(0-2)$ ✓ca

$1 = a$ ✓ca

$y = (x+4)(x-2)$ ✓ca

$y = x^2 + 2x - 8$ ✓ca

$y = g.h^x + i$ (4)



✓a, ✓a

$y = 4 \cdot h - 3$

$-1 = 4h - 3$ ✓m

$2 = 4h$

$\frac{1}{2} = h$ ✓ca

[13]

Question 6

Without solving for x, determine the nature of the roots of the following equation:

$x^2 - 4x = -3$ [4]

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

$b^2 - 4ac = \Delta$

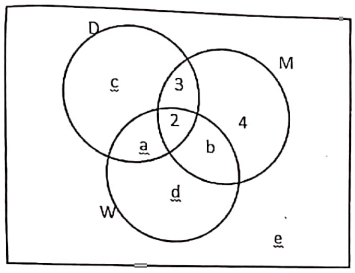
$(-4)^2 - 4(1)(3) = \Delta$ ✓a

$4 = \Delta$ ✓ca

∴ real and rational ✓ca ✓ca

If solve x give nature of root — max 3/4

Question 7



33 girls were asked about their chocolate preference - dark, milk or white.
2 liked all three
5 liked dark and milk
7 liked dark and white
6 liked white and milk
18 liked dark
12 liked white
4 liked milk only.

a) Determine the values of a – e. (5)

a = 5 ✓
b = 4 ✓
c = 8 ✓
d = 1 ✓
e = 6 ✓

b) What is the probability that a girl likes only one kind of chocolate? (2)

13 ✓9
33 ✓9

c) What is the probability that a girl who likes dark chocolate will choose milk chocolate? (2)

5 ✓4
18 ✓9

[9]

SECTION B

Question 8

a) 3; 12; x; 54; .... is a quadratic sequence.

i) Show by calculation that x = 29. (4)

if they used 29 to prove

T_1 T_2
3 12 x 54
(9) x-12 54-x ✓m
2x-12=9 54-x-(x-12) ✓9

x - 21 = -2x + 66 ✓ca9
3x = 87 ✓ca9
x = 29

0/4

ii) Hence, determine the general term of the sequence. (5)

2a = 8 ✓a9
a = 4 ✓ca
3(4) + b = 9
b = -3 ✓ca
4 + (-3) + c = 3
c = 2 ✓a9
$T_n = 4n^2 - 3n + 2$ ✓ca

iii) Determine which two terms in the quadratic sequence above will have a first difference of **73.** (7)

9; 17; 25 ✓m

$T_n = 9 + (n-1)8$ ✓a

$T_n = 8n + 1$

$73 = 8n + 1$ ✓ca

$n = 9$ ✓ca

$T_{10} - T_9 = T_9$ ✓m

$T_n = 4(9)^2 - 3(9) + 2$

$= 299$ ✓ca

$T_{10} - T_9 = 73$

$372 - 299 = 73$ ✓cg

b) If the following sequence is a geometric pattern.
Calculate the common ratio and write down the next two terms of the sequence. (3)

$4x; 8x^2; 16x^3; \ldots\ldots$

$r = \frac{8x^2}{4x}$

$= 2x$ ✓cg

$16x^3 \times 2x$

$= 32x^4$ ✓cg

$32x^4 \times 2x$

$= 64x^5$ ✓cg

[19]

Question 9

a) Bob runs a small car wash business. He starts saving for new equipment, by investing at 7,5% p.a. compounded quarterly.

i) What effective rate would give him the same return on his investment? (3)

$1 + ie = \left(1 + \frac{7,5\%}{4}\right)^4$ ✓a

✓cg

$ie = 7,7\%$ ✓cg

ii) Bob deposits R10 000 immediately.

The interest rate for the first year is 7,5% compounded quarterly.

At the end of the first year, the interest changes to 7,8% compounded monthly.

6 months later, the rate again changes, to 7% compounded monthly and he deposits another R 5000.

By how much would his investment have grown at the end of the 3rd year? (5)

$10000\left(1 + \frac{7,5\%}{4}\right)^{4\times1}\left(1 + \frac{7,8\%}{12}\right)^{12\times\frac{1}{2}}\left(1 + \frac{7\%}{12}\right)^{12\times1\frac{1}{2}} + 5000\left(1 + \frac{7\%}{12}\right)^{12\times1}$

✓a ✓cg ✓m ✓cg

$= 17986,17$ ✓cg

b) Suzie opened a savings account by depositing R15 000 immediately. 2 years later she withdrew Rx. After a further 3 years, she deposited another R21 500. At the end of 6 years, she had R30 000 in her bank account. Interest is compounded at 6% pa compounded monthly.
Calculate the value of x. (5)

$15000\left(1+\frac{6\%}{12}\right)^{6\times12} - x\left(1+\frac{6\%}{12}\right)^{12\times4} + 21500\left(1+\frac{6\%}{12}\right)^{12} = 30000$

$-x\left(1+\frac{6\%}{12}\right)^{12\times4} = -14306,74$

$x = 11260,81$

0	2	5	6
15000	$-x$	21500	

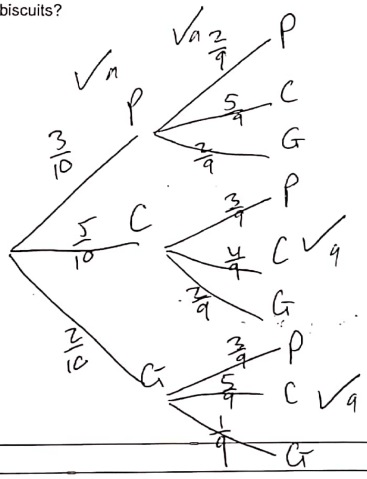
[13]

Question 10

a) After exams, you settle down in front of the TV to watch a movie. Your Mom puts a plate of biscuits next to you containing 10 biscuits with assorted flavours:

You get so engrossed in the movie that you don't look to see what biscuit you are choosing.

What is the probability that you have eaten at least 1 chocolate chip biscuit after eating 2 biscuits?



$\frac{3}{10}\times\frac{5}{9} + \frac{5}{10}\times\frac{3}{9} + \frac{5}{10}\times\frac{4}{9} + \frac{5}{10}\times\frac{2}{9} + \frac{2}{10}\times\frac{5}{9}$

$= \frac{7}{9}$

Form 4 November 2019 Paper 1

b)

Age of driver	2 accidents or less	More than 2 accidents	Total
40 or younger	200	100	300
Older than 40	50	50	100
Total	250	150	400

400 drivers were interviewed about the number of accidents they were involved in while driving. The results were summarised in the table above.

Is the number of accidents independent of the age of the driver?
Show the calculations used. (5)

P(older than 40 and 2 accid or less) $= \frac{50}{400} = \frac{1}{8}$ ✓a

P(older than 40) × P(2 accid or less)

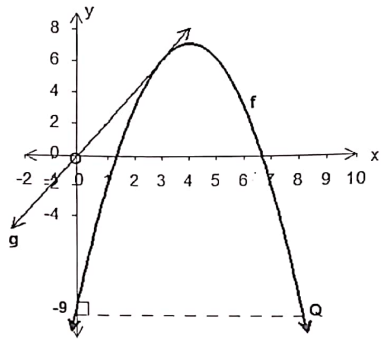
$= \frac{100}{400}$ ✓a × $\frac{250}{400}$ ✓a

$= \frac{5}{32}$ ✓ca

∴ not independent ✓ca.

[11]

Question 11



$f(x) = ax^2 + bx + c$ and $g(x) = 2x$

The point (4; 7) is the turning point of the parabola.

a) Write down the co-ordinates of Q. (1)

Q(8; −9) ✓a

b) Show by calculation that $f(x) = -x^2 + 8x - 9$. (4)

$y = a(x-4)^2 + 7$ ✓a

$-9 = a(8-4)^2 + 7$ ✓m

$-1 = a$ ✓ca

$y = -(x-4)^2 + 7$

$y = -(x^2 - 8x + 16) + 7$ ✓ca

c) Give the new equation of $h(x)$ if $h(x) = f(x+3)$ and describe the transformation that occurred. (3)

in simplest form.

$h(x) = -(x+3)^2 + 8(x+3) - 9$ ✓m

$= -x^2 + 2x + 6$ ✓ca

∴ shifted ✓a left 3 units

d) Give the new equation of $t(x)$ if $t(x) = -f(x)$ and describe the transformation that occurred. (2)

$t(x) = x^2 - 8x + 9$ ✓a reflected in ✓a x-axis

e) If $-x^2 + 8x - 9 = 2x + k$
What must the value of k be so that there are two real roots. (2)

$k < 0$ ✓a ✓a

$-x^2 + 6x - 9 - k = 0$ ✓

$(6)^2 - 4(-1)(-9-k) > 0$

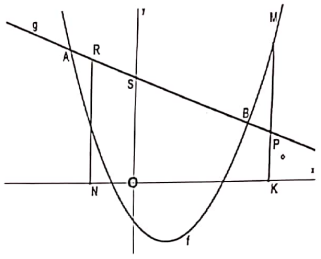
$36 + 4(-9-k) > 0$

$36 - 36 - 4k > 0$ ✓

$k < 0$ [12]

Question 12

Look at the sketch graph alongside (not according to scale) of the parabola $f(x) = x^2 - 3x - 4$ and straight line $g(x) = -x + 11$. The graphs intersect at A and B.



Determine:

a) The length of OK if MP is 33 units. (5)

$MP = x^2 - 3x - 4 - (-x + 11)$ ✓a

$33 = x^2 - 3x - 4 + x - 11$ ✓m

$0 = x^2 - 2x - 48$ ✓ca

$0 = (x-8)(x+6)$ ✓ca

$x = 8$ or $x = -6$

$OK = 8$ units ✓ca

b) The maximum length of TR (5)

$RT = -x + 11 - (x^2 - 3x - 4)$ ✓a

$= -x^2 + 2x + 15$ ✓ca

$x = \frac{-2}{2(-1)}$ ✓m

$= 1$ ✓ca

$RT = -(1)^2 + 2(1) + 15$

$= 16$ ✓ca

$-12 = \frac{1}{4}x^2 + px - 3$ ✓

$-9 = \frac{1}{4}x^2 + px$

$0 = \frac{1}{4}x^2 + px + 9$ ✓

$\Delta = 0$ ✓

$b^2 - 4ac = 0$

$p^2 - 4(\frac{1}{4})(9) = 9$ ✓

$p^2 = 9$

$p = \pm 3$ ✓

Question 13

Given that $f(x) = \frac{1}{4}x^2 + px - 3$ and the minimum value of $f(x)$ is –12.

Determine the value(s) of p. **[5]**

$x = \frac{-p}{2(\frac{1}{4})}$ ✓a

$-12 = \frac{1}{4}\left(\frac{-p}{\frac{1}{2}}\right)^2 + p\left(\frac{-p}{\frac{1}{2}}\right) - 3$ ✓m

$-12 = \frac{1}{4}(4p^2) - 2p^2 - 3$ ✓a

$-12 = p^2 - 2p^2 - 3$ ✓ca

$\pm 3 = p$ ✓ca

$f(x) = \frac{1}{4}(x^2 + 4px - 12)$ ✓ $\left(\frac{4p}{2}\right)^2 = 2^2p^2$

$= \frac{1}{4}[(x+2p)^2 - 12 \mp 4p^2]$

$= \frac{1}{4}\{(x+2p)^2 - 12 \pm 4p^2\}$ ✓ ✓

$\therefore -\frac{12}{4} \mp \frac{4p^2}{4} = -12$ ✓

$-p^2 = -12 + 3$

$-p^2 = -9$

$p = \pm 3$ ✓

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