3 (a) Write 2.46×10^6 as an ordinary number.

$\times 10^6$

2 460 000

2 460 000

(1)

(b) Write 0.000 74 in standard form.

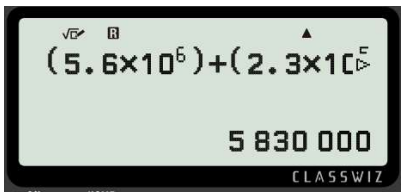
$\times 10^{-4}$

0.000 74

7.4×10^{-4}

(1)

(c) Work out $(5.6 \times 10^6) + (2.3 \times 10^5)$



5830 000

(2)

(Total for Question 3 is 4 marks)

5 (a) Write 5.7×10^{-3} as an ordinary number.

$\times 10^{-3}$

0·0057

0·0057

(1)

(b) Write 800 000 in standard form.

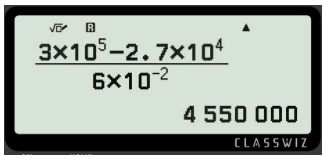
$\times 10^{5}$

800 000

8×10^{5}

(1)

(c) Work out $\dfrac{3 \times 10^5 - 2.7 \times 10^4}{6 \times 10^{-2}}$



4 550 000

(2)

(Total for Question 5 is 4 marks)

5 (a) Write 8×10^4 as an ordinary number.

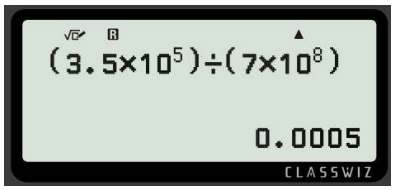
$\times 10^4$

80000

80000

(1)

(b) Work out $(3.5 \times 10^5) \div (7 \times 10^8)$
Give your answer in standard form.



$\times 10^{-4}$

0.0005

5×10^{-4}

(2)

(Total for Question 5 is 3 marks)

6 (a) Write down the value of y^0

anything^0 = 1

1

(1)

(b) Work out $\dfrac{9.6 \times 10^{141} + 6.4 \times 10^{140}}{3.2 \times 10^{16}}$

Give your answer in standard form.

$9.6 \times 10^{141} = 96 \times 10^{140}$

$96 \times 10^{140} + 6.4 \times 10^{140} = 102.4 \times 10^{140}$

$\dfrac{102.4 \times 10^{140}}{3.2 \times 10^{16}}$

$102.4 \div 3.2 = 32$

$10^{140} \div 10^{16} = 10^{124}$

32×10^{124}

3.2×10^{125}

(3)

(Total for Question 6 is 4 marks)

6 (a) Write 2 840 000 000 in standard form.

$\times 10^9$

2840 000 000

2.84×10^9

(1)

(b) Write 2.5×10^{-4} as an ordinary number.

$\times 10^{-4}$

0.00025

0.00025

(1)

(Total for Question 6 is 2 marks)

6 (a) Write 76 000 000 in standard form.

$\times 10^7$

76000 000

7.6×10^7

(1)

(b) Write 5.4×10^{-4} as an ordinary number.

$\times 10^{-4}$

0.00054

0.00054

(1)

(Total for Question 6 is 2 marks)

6 (a) Write 7.8×10^{-4} as an ordinary number.

$\times 10^{-4}$

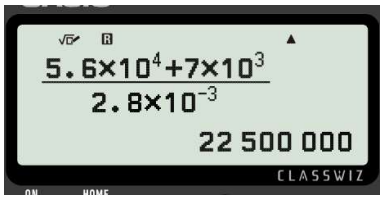
0.00078

0·00078

(1)

(b) Work out $\dfrac{5.6 \times 10^4 + 7 \times 10^3}{2.8 \times 10^{-3}}$

Give your answer in standard form.



2.25×10^7

(2)

(Total for Question 6 is 3 marks)

7 (a) Write 9.32×10^{-5} as an ordinary number.

$\times 10^{-5}$

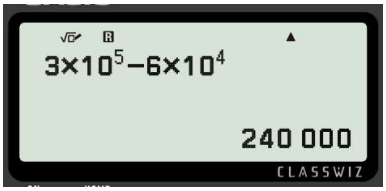
0.00009 32

0·0000932

(1)

(b) Work out $3 \times 10^5 - 6 \times 10^4$

Give your answer in standard form.



$2 \cdot 4 \times 10^5$

(2)

(c) Work out $(3 \times 10^{55}) \times (6 \times 10^{65})$

Give your answer in standard form.

$3 \times 6 = 18$

$10^{55} \times 10^{65} = 10^{55+65}$

$= 10^{120}$

(2)

(Total for Question 7 is 5 marks)

18×10^{120}

$1 \cdot 8 \times 10^{121}$

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

7 The table shows the volumes, in km^3, of four oceans.

Ocean	Volume (km^3)
Arctic Ocean	1.88×10^7
Atlantic Ocean	3.10×10^8
Indian Ocean	2.64×10^8
Southern Ocean	7.18×10^7

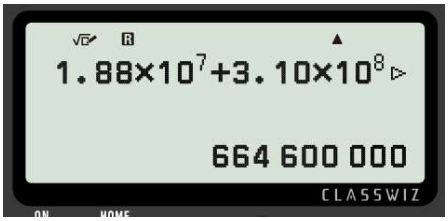
(a) Write 7.18×10^7 as an ordinary number.

x10^7
7 18 00000

7.18×10^7

(1)

(b) Calculate the total volume of these four oceans.



..... km^3

(2)

The volume of the South China Sea is 9 880 000 km^3

(c) Write 9 880 000 in standard form.

x10^6
9 880 000

9.88×10^6

(1)

(Total for Question 7 is 4 marks)

DO NOT WRITE IN THIS AREA DO NOT WRITE IN THIS AREA DO NOT WRITE IN THIS AREA

7 Write 3.6×10^3 as a product of powers of its prime factors.
Show your working clearly.

3.6×10^3

$\times 10^3$

3600

3600

2 1800

2 900

2 450

2 225

3 75

3 25

5 5

$2^4 \times 3^2 \times 5^2$

(Total for Question 7 is 3 marks)

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

7 (a) Write 5.7×10^6 as an ordinary number.

$\times 10^6$

5700 000

5700000

(1)

(b) Write 0.004 in standard form.

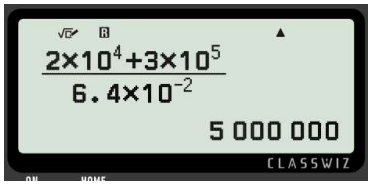
$\times 10^{-3}$

0.004

4×10^{-3}

(1)

(c) Work out $\dfrac{2 \times 10^4 + 3 \times 10^5}{6.4 \times 10^{-2}}$



(2)

(Total for Question 7 is 4 marks)

8 $a = 4.2 \times 10^{-24}$ $b = 3 \times 10^{145}$

Work out the value of $a \times b$
Give your answer in standard form.

$4.2 \times 10^{-24} \times 3 \times 10^{145}$

$4.2 \times 3 = 12.6$

$10^{-24} \times 10^{145} = 10^{-24+145}$

$= 10^{121}$

1.26×10^{122}

(Total for Question 8 is 2 marks)

12.6×10^{121}

1.26×10^{122}

8 The table gives the length of the coastline, in kilometres, of each of five oceans.

Ocean	Length of coastline (km)
Arctic	4.539×10^4
Atlantic	1.119×10^5
Pacific	1.357×10^5
Indian	6.653×10^4
Southern	1.797×10^4

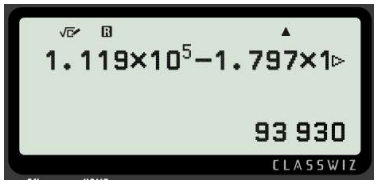
45390
111900
135700
66530
17970

(a) Which ocean has the greatest length of coastline?

Pacific

(1)

(b) Calculate the difference between the length of the Atlantic Ocean's coastline and the length of the Southern Ocean's coastline.
Give your answer in standard form.



9.393×10^4 km

(2)

(Total for Question 8 is 3 marks)

8 (a) Write 1 390 000 in standard form.

$\times 10^6$

1 390 000

1.39×10^6

(1)

(b) Write 0.005 in standard form.

$\times 10^{-3}$

0.005

5×10^{-3}

(1)

(Total for Question 8 is 2 marks)

8 (a) Write 5×10^4 as an ordinary number.

50000

50000

(1)

(b) Write 0.000 06 in standard form.

0·000 06

6×10^{-5}

(1)

(c) Work out $(4 \times 10^{512}) \div (1.6 \times 10^{700})$
Give your answer in standard form.

$4 \div 1.6 = 2.5$

$10^{512} \div 10^{700} = 10^{512-700}$

$= 10^{-188}$

2.5×10^{-188}

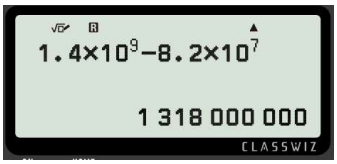
(2)

(Total for Question 8 is 4 marks)

8 The table shows the populations of five countries.

Country	Population
China	1.4×10^9
Germany	8.2×10^7
Sweden	9.9×10^6
Fiji	9.1×10^5
Malta	4.3×10^5

(a) Work out the difference between the population of China and the population of Germany.
Give your answer in standard form.



$1 \cdot 318 \times 10^9$

.....

(2)

Given that

$$\text{population of Fiji} = \frac{1}{k} \times \text{population of Sweden}$$

(b) work out the value of k.
Give your answer correct to the nearest whole number.

$9 \cdot 1 \times 10^5 = \frac{1}{k} \times 9 \cdot 9 \times 10^6$

$\frac{9 \cdot 1 \times 10^5}{9 \cdot 9 \times 10^6} = \frac{1}{k}$

$k = \frac{1}{9 \cdot 1 \times 10^5 / 9 \cdot 9 \times 10^6}$

$k =$ .....

(2)

(Total for Question 8 is 4 marks)

$k = 10 \cdot 879$ $\quad k = 11$

8 (a) Write 0.000089 in standard form.

$\times 10^{-5}$

0.000089

8.9×10^{-5}

(1)

(b) Write 8.34×10^4 as an ordinary number.

$\times 10^4$

83400

83400

(1)

(Total for Question 8 is 2 marks)

8 (a) Write 5.6×10^{-3} as an ordinary number.

$\times 10^{-3}$

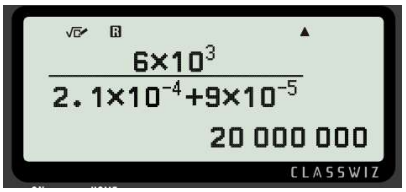
$0 \cdot 0056$

$0 \cdot 0056$

(1)

(b) Work out $\dfrac{6 \times 10^3}{2.1 \times 10^{-4} + 9 \times 10^{-5}}$

Give your answer in standard form.



2×10^7

(2)

(Total for Question 8 is 3 marks)

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

9 The table gives information about the population, correct to 2 significant figures, of each of five cities in 2018

City	Population (2018)
Ahmedabad	7.7×10^6
Barcelona	5.5×10^6
Chicago	8.8×10^6
Lagos	1.3×10^7
Tokyo	3.7×10^7

7700000
5500000
8800000
13000000
37000000

(a) Write 8.8×10^6 as an ordinary number.

$\times 10^6$
8 800 000

8 800 000

(1)

(b) Which of these cities had the least population in 2018?

Barcelona

(1)

(c) Work out the difference between the population of Tokyo and the population of Ahmedabad in 2018
Give your answer in standard form correct to 2 significant figures.

2.9×10^7

(2)

(Total for Question 9 is 4 marks)

9 $N = 480 \times 10^9$

(a) Write N as a number in standard form.

$\times 10^{11}$

480 000 000 000

4.8×10^{11}

(1)

(b) Write N as a product of powers of its prime factors.
Show your working clearly.

$4.8 \times 10^{11} = 48 \times 10^{10}$

$10^{10} = (2 \times 5)^{10}$
$= 2^{10} \times 5^{10}$

48
2 24
2 12
2 6
2 3

48×10^{10}
$2^4 \times 3 \times 2^{10} \times 5^{10}$
$= 2^{14} \times 3 \times 5^{10}$

(3)

(c) Find the largest factor of N that is an odd number.

3×5^{10}

29296875

(1)

(Total for Question 9 is 5 marks)

9 (a) Write 840 000 in standard form.

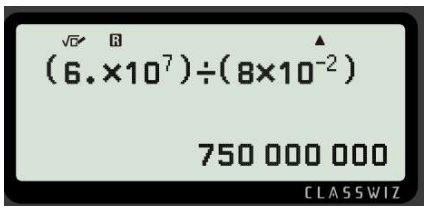
$\times 10^5$

$840\,000$

8.4×10^5

(1)

(b) Work out $(6 \times 10^7) \div (8 \times 10^{-2})$
Give your answer in standard form.



7.5×10^8

(2)

(Total for Question 9 is 3 marks)

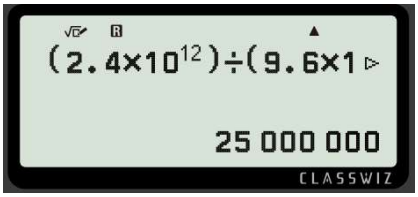
9 (a) Write 6.25×10^{-4} as an ordinary number.

$\times 10^{-4}$

0.000625

(1)

(b) Work out $(2.4 \times 10^{12}) \div (9.6 \times 10^{4})$
Give your answer in standard form.



2.5×10^{7}

(2)

(Total for Question 9 is 3 marks)

9 The table gives the amount of rice produced by each of two countries in 2020

Country	Amount of rice (tonnes)
Indonesia	3.5×10^7
Argentina	8.2×10^5

(a) Write 3.5×10^7 as an ordinary number.

$\times 10^7$

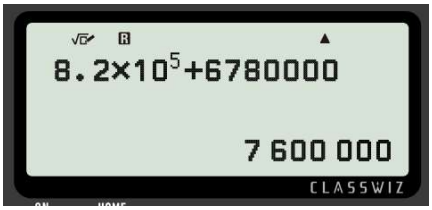
35 000 000

35 000 000

(1)

In 2020, Japan produced 6 780 000 more tonnes of rice than Argentina.

(b) Work out the amount of rice Japan produced in 2020
Give your answer in standard form.



7.6×10^6

..... tonnes

(2)

(Total for Question 9 is 3 marks)

9 (a) Write 6.04×10^5 as an ordinary number.

$\times 10^5$

$6\overbrace{04\,000}$

604000

(1)

(b) Write 0.000 07 in standard form.

$\times 10^{-5}$

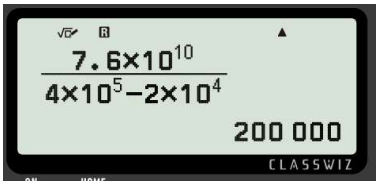
$\overbrace{0.00007}$

7×10^{-5}

(1)

(c) Work out $\dfrac{7.6 \times 10^{10}}{4 \times 10^5 - 2 \times 10^4}$

Give your answer in standard form.



2×10^5

(2)

(Total for Question 9 is 4 marks)

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DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

9 (a) Write 8.4×10^{-5} as an ordinary number.

$\times 10^{-5}$

0.000084

8.4×10^{-5}

(1)

(b) Work out $(6.5 \times 10^{-40}) \times (8 \times 10^{185})$
Give your answer in standard form.

$6.5 \times 8 = 52$

$10^{40} \times 10^{185} = 10^{40+185}$

$= 10^{225}$

52×10^{225}

$\downarrow$ $\uparrow$

5.2×10^{126}

(2)

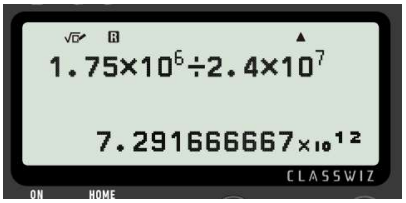
(Total for Question 9 is 3 marks)

9 A rainwater tank contains 2.4×10^7 raindrops.
The rainwater tank also contains 1.75×10^6 bacteria.

(a) Work out the number of bacteria per raindrop in the tank.
Give your answer in standard form correct to 2 significant figures.

Bacteria per drop

$1.75 \times 10^6 \div 2.4 \times 10^7$



7.3×10^{12}

.....

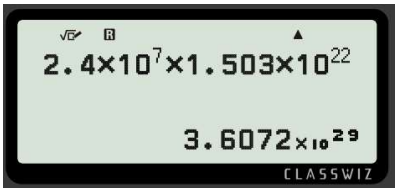
(3)

A drop of rainwater contains 5.01×10^{21} atoms.

In a drop of rainwater the number of atoms is 3 times the number of molecules.

(b) Work out the number of molecules in the rainwater tank.
Give your answer in standard form correct to one significant figure.

In each drop



In whole tank

4×10^{29} ..... molecules

(2)

(Total for Question 9 is 5 marks)

9 (a) Write 5.87×10^{-4} as an ordinary number.

$\times10^{-4}$

0.000587

0·000587

(1)

(b) Write 84 000 000 in standard form.

$\times10^{7}$

84 000 000

8.4×10^{7}

(1)

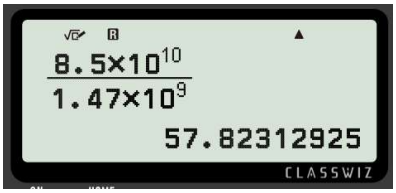
The number of neurons in a human brain is 8.5×10^{10}
The number of neurons in a monkey brain is 1.47×10^{9}

The number of neurons in a human brain is $K\times$ the number of neurons in a monkey brain.

(c) Work out the value of K
Give your answer correct to one decimal place.

Human = k x monkey

$\frac{\text{Human}}{\text{monkey}} = k$



$k = 57.8$

$K =$ .....

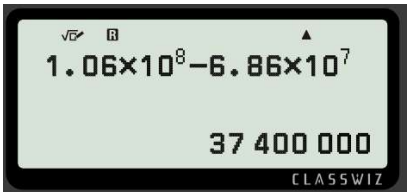
(2)

(Total for Question 9 is 4 marks)

10 The table shows information about the surface area of each of the world's oceans.

Ocean	Surface area in square kilometres
Pacific	1.56×10^8
Indian	6.86×10^7
Southern	2.03×10^7
Arctic	1.41×10^7
Atlantic	1.06×10^8

(a) Work out the difference, in square kilometres, between the surface area of the Atlantic Ocean and the surface area of the Indian Ocean.
Give your answer in standard form.



$\times 10^7$

$3\,7\,400\,000$

3.74×10^7 square kilometres

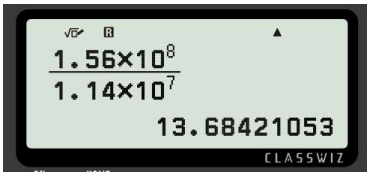
(2)

The surface area of the Pacific Ocean is k times the surface area of the Arctic Ocean.

(b) Work out the value of k.
Give your answer correct to the nearest whole number.

Pacific = k x Arctic

$\frac{\text{Pacific}}{\text{Arctic}} = k$



$k = 14$

$k =$ .....

(1)

(Total for Question 10 is 3 marks)

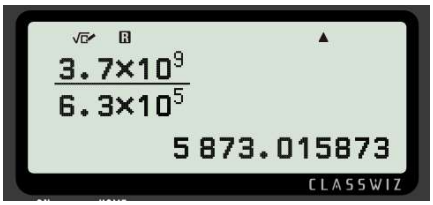
10 The table gives information about the population and the total amount of money, in dollars, spent on healthcare for two countries in 2016

Country	Total population	Total spent on healthcare ($)
Austria	8.7×10^6	4.2×10^{10}
Luxembourg	6.3×10^5	3.7×10^9

Work out how much more was spent **per person** on healthcare in Luxembourg than in Austria.
Give your answer correct to the nearest whole number.

(A)

(L)



5873.02 - 4827.59

= 1045.43

= 1045

..... dollars

(Total for Question 10 is 3 marks)

DO NOT WRITE IN THIS AREA

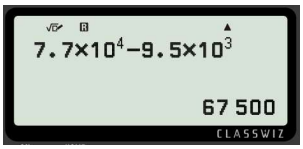
DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

11 The table gives the average crowd attendance per match for each of five football clubs for one season.

Football club	Average crowd attendance
Monaco	9.5×10^3
Chelsea	4.2×10^4
Juventus	3.9×10^4
Oxford United	8.3×10^3
Barcelona	7.7×10^4

(a) Find the difference between the average crowd attendance for Barcelona and the average crowd attendance for Monaco.
Give your answer in standard form.



6.75×10^4

(2)

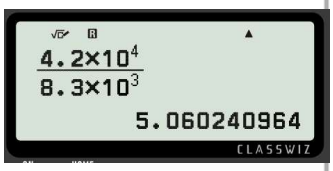
Antonio says,

"The average crowd attendance for Chelsea is approximately 50 times that for Oxford United."

(b) Is Antonio correct?
You must give a reason for your answer.

Chel = 50 x Oxf

$\frac{Chel}{Oxf} = 50$



He is incorrect, it is 5 times not 50 times as big

(2)

During last season the cost of a ticket to watch Seapron United increased by 15% and then decreased by 8%

↑15 x115%.
↓8 x92%.

(c) Work out the overall percentage change in the cost of a ticket to watch Seapron United during last season.

Start 100 → x115% → x92% → 105.8

5.8% %

(2)

(Total for Question 11 is 6 marks)

12 $a = 6 \times 10^{40}$

Work out the value of a^3
Give your answer in standard form.

$a^3 = a \times a \times a$

$6 \times 6 \times 6 = 216$

$10^{40} \times 10^{40} \times 10^{40} = 10^{40+40+40}$

$= 10^{120}$

216×10^{140}

2.16×10^{142}

(Total for Question 12 is 3 marks)

12 Astrid wants to buy some oil.
She can buy the oil from either Dane Oil or Arctic Oil.

Here is information about the price that each company will charge Astrid.

Dane Oil	Arctic Oil
(4.2×10^5) litres for 2 500 000 Krone	(8.6×10^5) litres for 770 000 Dollars

Astrid wants to get the better value for money for the oil.

1 Dollar = 6.57 Krone

From which company should she buy her oil, Dane Oil or Arctic Oil?
You must show your working.

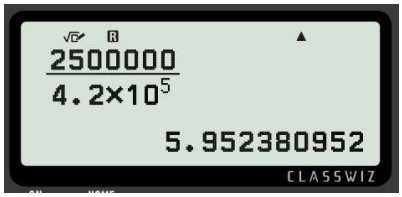
Dane

Arctic

1 dollar = 6·57 krone

770000 x 6·57

= 5058900 krone



5·95 krone per L

5·88 krone per L

Arctic oil is better value

(Total for Question 12 is 4 marks)

15 (a) $\sqrt{2} \div \dfrac{8^3}{16^{\frac{3}{2}}} = 2^n$

Work out the value of n
Show your working clearly.

$\sqrt{2} \div \dfrac{8^3}{16^{3/2}} = 2^n$ $\longrightarrow 2^{\frac{1}{2}} \div \dfrac{2^9}{2^6}$

$\sqrt{2} = 2^{\frac{1}{2}}$ $16^{3/2} = (2^4)^{3/2}$ $2^{\frac{1}{2}} \div 2^3$

$8^3 = (2^3)^3$ $= 2^6$ $2^{\frac{1}{2}-3}$

$= 2^9$ $2^{-\frac{5}{2}}$

$n =$ .....

(3)

(b) Find 4% of 4.5×10^{157}
Give your answer in standard form.

$4\% = 0.04$

$= 4 \times 0.01$

4% of $4.5 \times 10^{157} = 4 \times 10^{-2} \times 4.5 \times 10^{157}$

$4 \times 4.5 = 18$

$10^{-2} \times 10^{157} = 10^{-2+157}$

$= 10^{155}$

18×10^{155} ↑ ↓

.....

(3)

(Total for Question 15 is 6 marks)

1.8×10^{156}

DO NOT WRITE IN THIS AREA DO NOT WRITE IN THIS AREA DO NOT WRITE IN THIS AREA

20 $a = 25 \times 10^{14n}$ where n is an integer.

Find an expression, in terms of n, for $a^{\frac{3}{2}}$
Give your answer in standard form.

$a = 25 \times 10^{14n}$

$a^{3/2} = (25 \times 10^{14n})^{3/2}$

$= 25^{3/2} \times 10^{14n \times 3/2}$

$= (\sqrt{25})^3 \times 10^{21n}$

$= 5^3 \times 10^{21n}$

$= 125 \times 10^{21n}$

$= 1.25 \times 10^{21n+2}$

(Total for Question 20 is 3 marks)