2010 STELLA MARIS COLLEGE
TRIAL HIGHER SCHOOL CERTIFICATE

General Mathematics

General Instructions

- Reading time – 5 minutes
- Working time - 2½ hours
- Write using blue or black pen
- Approved Calculators may be used
- Write your Student Number and Teacher's name at
  the top of relevant pages as indicated
- A Formulae Sheet is provided at the back of this paper

Section I Pages 2 - 9
Total marks (**22**)

- Attempt Questions 1 – 22
- Allow about 30 minutes for this section

Section II pages 10 – 19
Total marks (**78**)

- Attempt Questions 23 – 28
- Allow about 2 hours for this section

Section I

Total marks (22)
Attempt Questions 1 – 22
Allow about 30 minutes for this section

Use the Multiple-Choice Answer sheet provided

1 The number 386.956 correct to two significant figures is:

(A) 39

(B) 386.95

(C) 386.96

(D) 390

2 Sylvie had a spherical candle mould whose volume was exactly one litre.

What was the radius of the mould in cm (correct to 1 decimal place)?

(A) 6.2

(B) 13.3

(C) 238.7

(D) 2356.2

3 $\dfrac{3.216\times10^{6}}{4.8\times10^{6}+2.1\times10^{3}}$ is nearest to:

(A) 2.1×10^{3}

(B) 1.54×10^{6}

(C) 6.6×10^{-1}

(D) 6.7×10^{-1}

4 A web designer earns $500 per week plus $150 commission for every website she designs. What is the minimum number of websites she must design in 4 weeks to earn at least $5000?

(A) 8

(B) 20

(C) 34

(D) 80

5 The back to back stem and leaf plot below shows the number of downloads per day of two bands "Antz" and "Psycho" from a certain site over a two week period.

Which statement is true when comparing the data for the daily number of downloads?

Antz	Stem	Psycho
7 4 2	0	8
9 8 7 5 3 1	1	2 5 5
6 6 4 0	2	2 4 5 6 7 8 9
2	3	0 5 8

(A) Antz had a higher mode than Psycho.

(B) Psycho had a higher mode than Antz.

(C) Antz had the higher range than Psycho.

(D) Psycho had the higher range than Antz.

6 John scored 120, 140, 180, 160 and 140 out of 200 in his first five tests.
He needs to maintain a mean of 150 or above to remain in his university class.
What must he score in his sixth test to have a mean of 150?

(A) 76

(B) 150

(C) 160

(D) 192

7 Kenny scored the following results in four tests: 70, 32, 29 and 80.
The following week he repeated the four tests and recorded an improvement of 5 marks in each test.

Which of the following statements will be true?

(A) The mean increases and the standard deviation remains the same

(B) The mean increases and the standard deviation will increase by 5

(C) The mean increases and the standard deviation will decrease by 5

(D) The mean and standard deviation will remain unchanged

8 The following table shows the fuel capacity and distance per litre of four cars.

CAR	TANK CAPACITY (Litres)	DISTANCE PER LITRE (Kilometres)
Camry	65	11
Commodore	73	8
Falcon	80	7
Magna	64	12

Which car would go furthest on a full tank?

(A) Camry

(B) Commodore

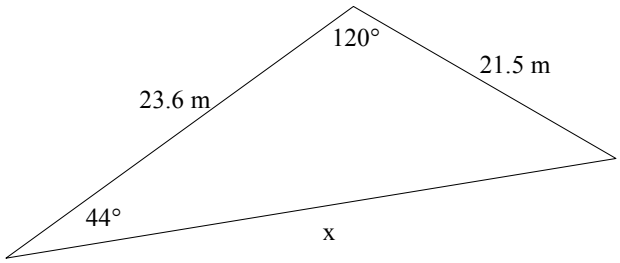
(C) Falcon

(D) Magna

9 The heights of the students in a school are normally distributed with a mean of 150 cm and a standard deviation of 15 cm. What percentage of students are more than 180 cm tall?

(A) 95% (B) 5% (C) 1% (D) 2.5%

10



NOT TO SCALE

The correct value for x is:

(A) $x = 23.6^2 + 21.5^2 - 2 \times 23.6 \times 21.5 \cos 120^\circ$

(B) $x = \sqrt{23.6^2 + 21.5^2 - 2 \times 23.6 \times 21.5 \cos 120^\circ}$

(C) $x = \dfrac{23.6 \sin 120^o}{\sin 44^o}$

(D) $x = \dfrac{21.5 \sin 44^o}{\sin 120^o}$

11 Simplify $\dfrac{12a^4b^3 \times 5a^2b^3}{15a^2b^3}$

(A) $4a^4b^2$ (B) $4a^4b^3$ (C) $4a^3b^2$ (D) $4a^3b^3$

12 The following table shows the income tax payable by Australian residents for the 2006-2007 financial year.

Taxable Income ($)	Tax payable on taxable income.
1 - 6000	nil
6001 - 30 000	15c for each $1 over $6000
30 001 - 75 000	$3600 + 30c for each $1 over $30 000
75 001 - 150 000	$17 100 + 40c for each $1 over $75 000
150 001 and over	$47 000 + 45c for each $1 over $150 000

Carl earned $56 200 during the 2006 - 2007 financial year. His allowable tax deductions were $4 200

How much income tax did he have to pay?

(A) $3 600 (B) $10 200 (C) $11 460 (D) $18 200

13 A set of scores has a mean of 58 and a standard deviation of 4.8. What mark corresponds to a Z-score of 2.5?

(A) 70

(B) 75

(C) 80

(D) 85

14 What equation represents the relationship between x and y in the following table?

x	-4	-1	2	5
y	-1	0	1	2

(A) $y = 3x - 1$

(B) $y = 3x + 1$

(C) $y = \dfrac{x+1}{3}$

(D) $x = 3y + 1$

15 This concrete block is used in a backyard garden.

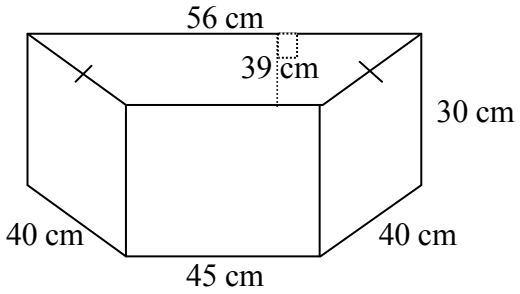
The volume of the block is:

(A) 1969.5 cm^3

(B) 34110 cm^3

(C) 59085 cm^3

(D) 65520 cm^3



16 Players in a sports competition are asked to write down their heights.
Which of the following best describes these data?

(A) Continuous

(B) Stratified

(C) Categorical

(D) Discrete

17 The table shows the number of students in each year of a school.

Year	Number of students
7	202
8	240
9	210
10	232
11	174
12	142

100 students from the school are to be surveyed. On a proportional basis, how many Year 8 students should be surveyed?

(A) 16

(B) 18

(C) 20

(D) 40

18 Sally takes out a loan of $4500 to buy a computer. Interest is charged at a flat rate of 10% p.a. and Sally repays the loan over 3 years.
What is the total amount that Sally will repay?

(A) $4545

(B) $1350

(C) $5900

(D) $5850

19 Burke Street is 650 m long. What would be its length on a map with a scale of 1 : 5000 ?

(A) 1.3 mm

(B) 13 mm

(C) 130 mm

(D) 1300 mm

20 Simplify $12 - 3(2x - 2)$

(A) $14 - 6x$

(B) $6 - 6x$

(C) $-6x + 6$

(D) $18 - 6x$

21 Kim borrowed \$300 000 to buy a house. She is paying it off monthly at an interest rate of 7.5% p.a. compounded monthly. The payments for the first 3 months are shown in the table below.

No. of months (N)	Principal (P)	Interest (I)	P + I	P + I – R R = repayment
1	300 000	1 875.00	301 875.00	299 775.00
2	299 775.00	1873.59	301 648.59	299 548.59
3	299 548.59	1872.18	301 420.77	299 320.77
4	299 320.77	X	Y	Z

The values for X, Y and Z are

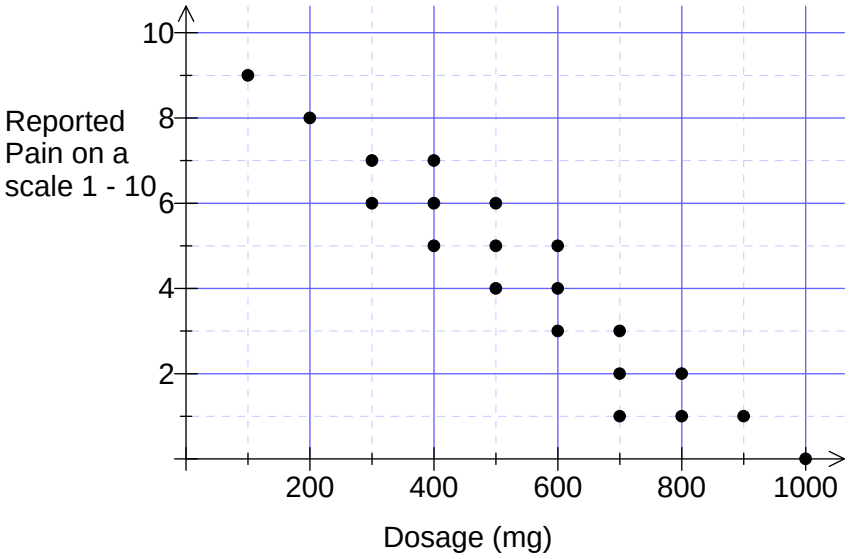
(A) X=\$224490.58, Y=\$523811.34, Z=\$521711.35

(B) X=\$2870.75, Y=\$302191.52, Z=\$309091.52

(C) X=\$4870.75, Y=\$601191.52, Z=\$320091.52

(D) X=\$1870.75, Y=\$301191.52, Z=\$299091.52

22 A scatter plot of pain (as reported by patients) compared to the dosage of a drug is shown below.



How could you describe the correlation between the pain and the dosage?

(A) A strong positive correlation.

(B) A strong negative correlation

(C) A weak positive correlation.

(D) No correlation.

Section II

Total marks (78)
Attempt Questions 23-28
Allow about 2 hours for this section

Start each question on a SEPARATE page/ booklet.

All necessary working should be shown in every question

Question 23 (13 marks) Use a separate booklet **Marks**

(a) This table shows the repayment per $1000 on a monthly reducible loan.

Term in years	*7%*	*7.25%*	*7.5%*	*7.75%*	*8%*	*8.25%*	*8.5%*
5	19.8012	19.9194	20.0379	20.1570	20.2765	20.3963	20.5164
10	11.6108	11.7401	11.8702	12.0011	12.1328	12.2653	12.3985
15	8.9883	9.1286	9.2701	9.4128	9.5566	9.7014	9.8474
20	7.7530	7.9036	8.0559	8.2095	8.3644	8.5207	8.6782
25	7.0678	7.2281	7.3899	7.5533	7.7182	7.8875	8.0522
30	6.6530	6.8218	6.9921	7.1641	7.3377	7.5127	7.6891

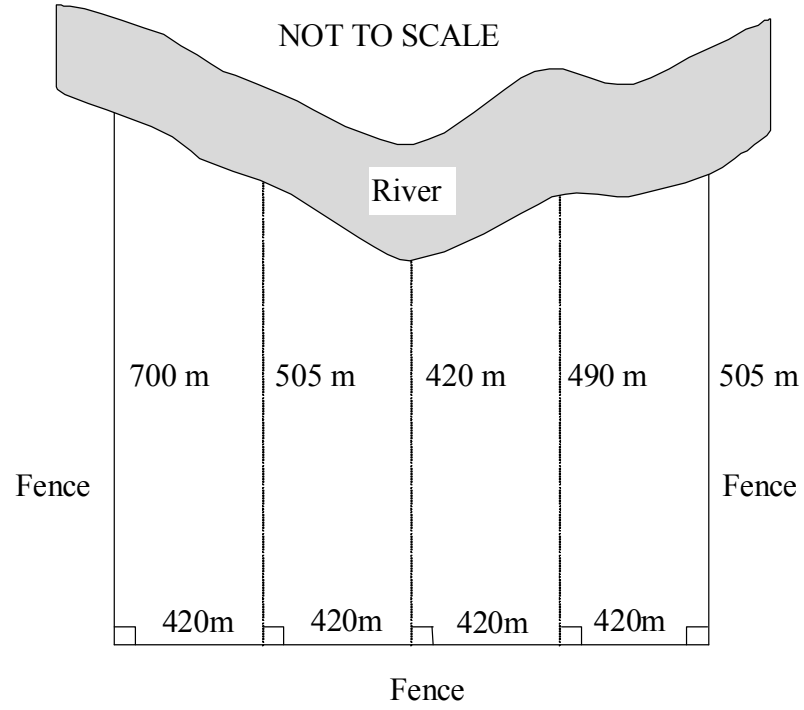
(i) Use the table above to find the monthly repayment per $1000 on a loan borrowed at 7% for 20 years. **1**

(ii) Calculate the monthly repayment on a loan of $60 000 at 7% over 20 years. **2**

(iii) Calculate the total amount repaid over the 20 year loan for the $60 000 borrowed. **1**

(iv) Determine how much interest was paid after the loan of $60 000 was fully paid in 20 years at 7% p.a. **2**

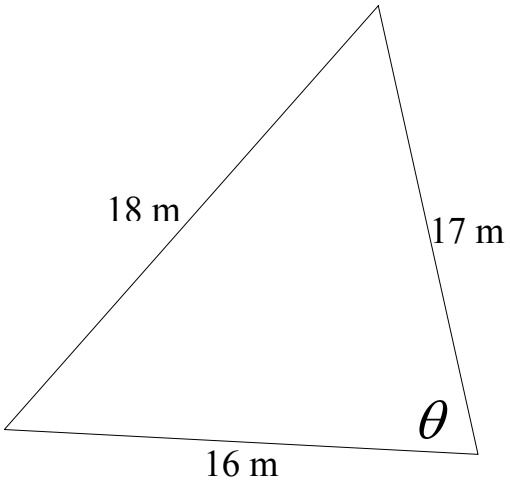
(b) The diagram below shows an area of land bounded by a river and fences. **Marks**



Use TWO applications of Simpson's rule to find the approximate area of this land. **3**

(c) The market value for Comlec shares is \$25.50. Calculate the dividend yield if the company pays a dividend of \$2.20 a share (correct to 2 decimal places). **2**

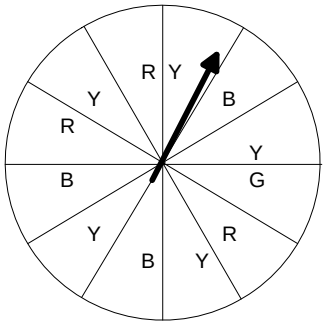
(d) Calculate the value of θ in the triangle below (correct to the nearest minute). **2**



Question 24 (13 marks) Use a separate booklet

Marks

(a) A spinner in a game has 12 equal sized sectors which are coloured Blue (B), Red (R) Green (G) or Yellow (Y) as shown in the diagram. It is spun a single time.



(i) What colour is the spinner most likely to land on? **1**

(ii) Which colours are equally likely? **1**

(iii) What is the probability the spinner will not land on a green sector? **1**

(b) Roy travels in his jet from his home at A (15°N, 120°E) to his brother's place at B (45°S, 30°W).

(i) When it is 12 noon on Friday in Roy's home, what time should it be in his brother's place? (ignoring time zones)? **2**

(ii) The journey from Roy's home to his brother's place takes 18 hours. If Roy arrives at his brother's place on Friday at 10 pm, what time did he leave his home? **2**

(c) A bank has three different types of savings accounts, as described in the table.

	Type A	Type B	Type C
Account service fees per month: • if minimum monthly balance stays at or above \$450 • if balance drops below \$450	Nil \$4.00	\$5.00 \$5.00	Nil Nil
Number of fee-free transactions per month	20	Unlimited	8
Fee per transaction over the free limit	90 cents	Nil	90 cents

Jackie has a type A account. In March, her minimum balance was \$280, and she made twenty one transactions.

(i) Calculate the fee she was charged for March. **1**

(ii) In any month, Jackie normally has between \$200 and \$300 in the bank. She usually makes about 22 transactions each month. Explain which account Jackie should choose at this bank in order to minimise fees, showing appropriate calculations to support your answer. **2**

(d) The table below shows the results of a phone survey of the voting intentions of 200 people chosen from the local phone book.

	Male	Female	Total
Liberal	40	17	57
Labor	45	16	61
Other	70	12	82
Total	155	45	200

(i) What percentage of females said they would vote Labor (to the nearest whole number)? **1**

(ii) What is the ratio of Liberal to Labor voters among the males, in simplest form? **1**

(iii) This poll is not a good random sample of the voting population. Outline one reason for this. **1**

Question 25 (13 marks) Use a separate booklet **Marks**

(a) The growth of bacteria in a colony is given by the equation: $N=600(1.04)^t$, where n is the number of bacteria in the colony and 't' is the time in months.

(i) Find the number of bacteria in the colony initially. **1**

(ii) Calculate the number of bacteria in the colony after 4 months. **1**

(iii) At what rate is the number of bacteria in the colony increasing. **1**

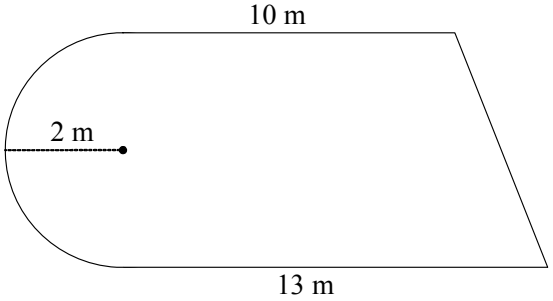
(b) The formula for the volume of a cone is $v = \frac{1}{3}\pi r^2 h$

where V = volume, h = height and r = radius

(i) Show that the radius of the cone is $r = \sqrt{\frac{3V}{\pi h}}$ **2**

(ii) Calculate the radius of the base of a cone (correct to 2 decimal places) that is 20cm high and has a volume of 200 cm^3. **1**

(c) The following diagram shows the area of a paddock, which is made up of a semi-circle and a trapezium.



NOT TO SCALE

Find the perimeter of the paddock (correct to 1 decimal place). **3**

(d) Alma's car rentals charges a cost (C) of $120 per day for the hire of a car plus an insurance fee of $80. Let n be the number of days.

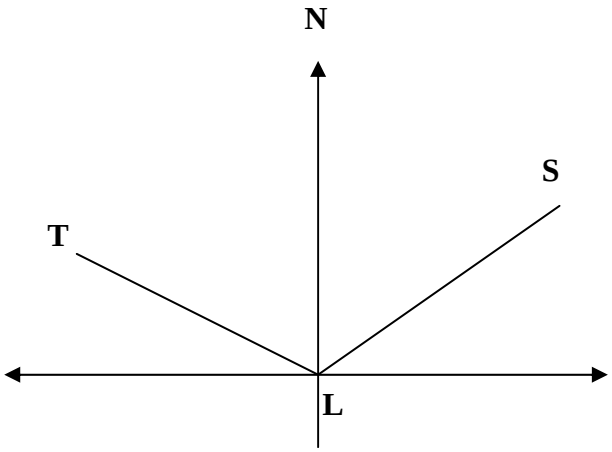
(i) Write the formula for the cost C of hiring a car for n days. **1**

(ii) Jenny hired a car and her total bill was $1520. How many days did Jenny hire the car for? **1**

(e) Solve for x $\frac{2(x-1)}{3} = \frac{3x+3}{4}$ **2**

Question 26 (13 marks) Use a separate booklet **Marks**

(a) A ship S is $N25^0E$ and 12 nautical miles from a tower L. A tanker T, is $N38^0W$ and 7 nautical miles from the tower.



(i) Draw the above diagram into your writing book and label the information given. **1**

(ii) Find the distance of the ship to the tanker (correct to 2 decimal places). **2**

(iii) Find the bearing, to the nearest degree, of the ship from the tanker. **2**

(b) The surveyor's notebook entries for the temporary car park at a local shopping centre are shown below.

D		
80		
30		120 C
0		80 B
A		

(i) Draw a sketch of the car park. **1**

(ii) (α) Find the perimeter (in metres) of the car park. **2**

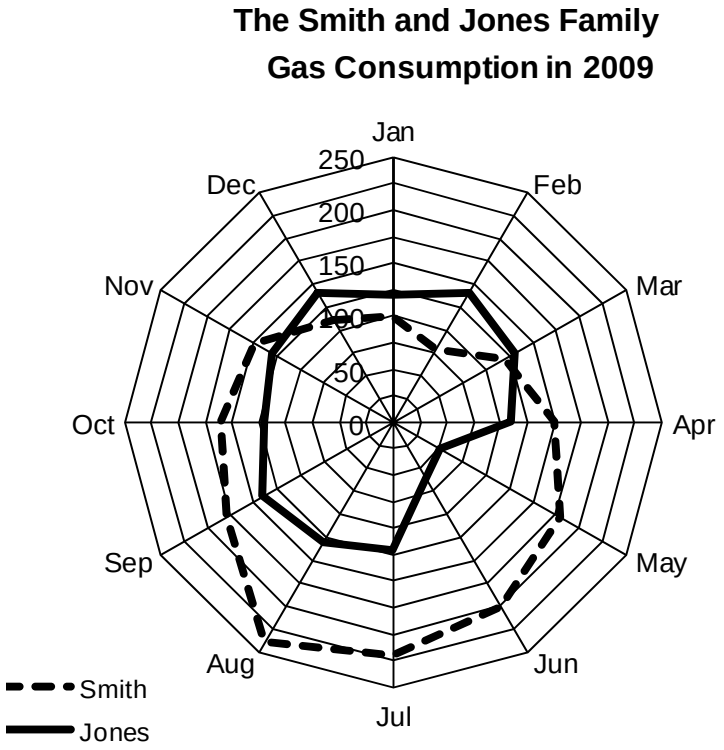
(β) A security fence is to be built around the car park. The security fence comes in 3-metre sections and costs \$25 each. Calculate the total cost of this security fence. (Correct to the nearest dollar) **2**

(iii) Calculate the area of the temporary car park. **2**

(iv) The concrete for the car park is to be 0.15 m thick. How much concrete (in m^3) will be needed to cover the car park? **1**

Question 27 (13 marks) Use a separate booklet

(a) The radar chart below compares the usage of Natural Gas by two families over a year. **Marks**



(i) One family used Gas for cooking and heating and the other for cooking only. Determine which family used gas for heating and explain your choice. **1**

(ii) The Jones family went away for six weeks during the year. During which months was this? **1**

(iii) The Smith family had a larger mean and larger standard deviation for their monthly gas usage than the Jones family. Using the information on the graph explain why the Smith families results are the larger for these two measures. **2**

(b) John purchases a car for $53 200 and uses the declining balance method to depreciate at 10% p.a.

(i) From the table below calculate the values of X and Y

Years	Amount of depreciation ($)	Salvage value ($)
0	0	53 200
1	5320	47 880
2	X	Y

2

(ii) When will the car be worth $30 000, to the nearest tenth of a year? **1**

(c) The table below compares the mean and standard deviation of the times (in minutes) of male and female athletes in a club on their 20 km training run. The times for both males and females are distributed normally.

Sex	Mean Time	Standard Deviation
Male	60.2	5.8
Female	62.5	3.6

(i) Melissa runs 20 km in 55.3 minutes. Convert her time to a z-score. **1**

(ii) Jason runs 20 km in 54.4 minutes. What percentage of males had a lesser time than Jason? **2**

(iii) Did Melissa or Jason perform better in comparison to the other members of their respective sex? Explain your answer. **1**

(d) Heather, who lives at Broken Hill, looks up the latitude and longitude information shown in the table below.

Location	Latitude	Longitude
Broken Hill (NSW)	32^o S	141^o E
Glasgow (UK)	56^o N	4^o W
Sapporo (Japan)	43^o N	141^o E

(i) Heather has an internet pen friend in Sapporo, Japan. What is the angular distance between their home towns? **1**

(ii) Given that 1^o subtends 60 nautical miles and that 1 nautical mile = 1.852 km, how many kilometres apart are their home towns? **1**

Question 28 (13 marks) Use a separate booklet **Marks**

(a) Bill invested \$800 at the end of every 6 months for 10 years, in an account which earned compound interest of 2% per half year.

(i) Show that the value of Bill's investment at the end of 10 years was \$19437.90. **2**

(ii) What single amount of money would Bill have to invest for 10 years, earning 2% per half year compound interest, for it to have a value of \$19437.90. **2**

(b) Scientists have shown that the mass(m) in grams of an egg varies directly with the cube of its length (l) in cm.

An egg 6 cm in length has a mass of 84 grams.

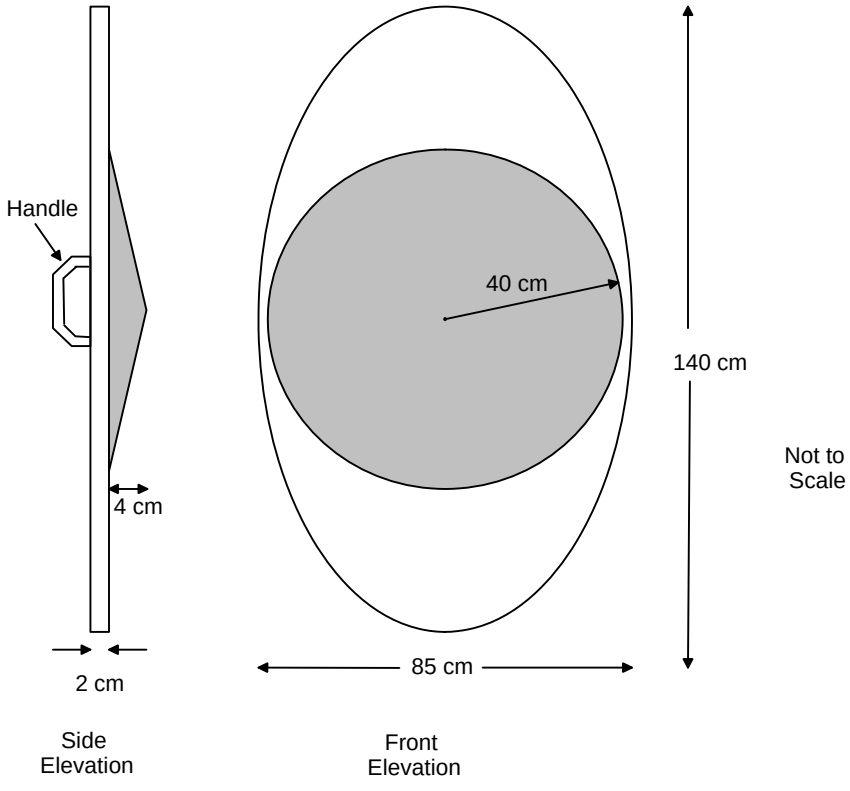
(i) Write an equation connecting m and l **2**

(ii) Find the mass of an egg with a length of 5 cm, correct to 1 decimal place. **1**

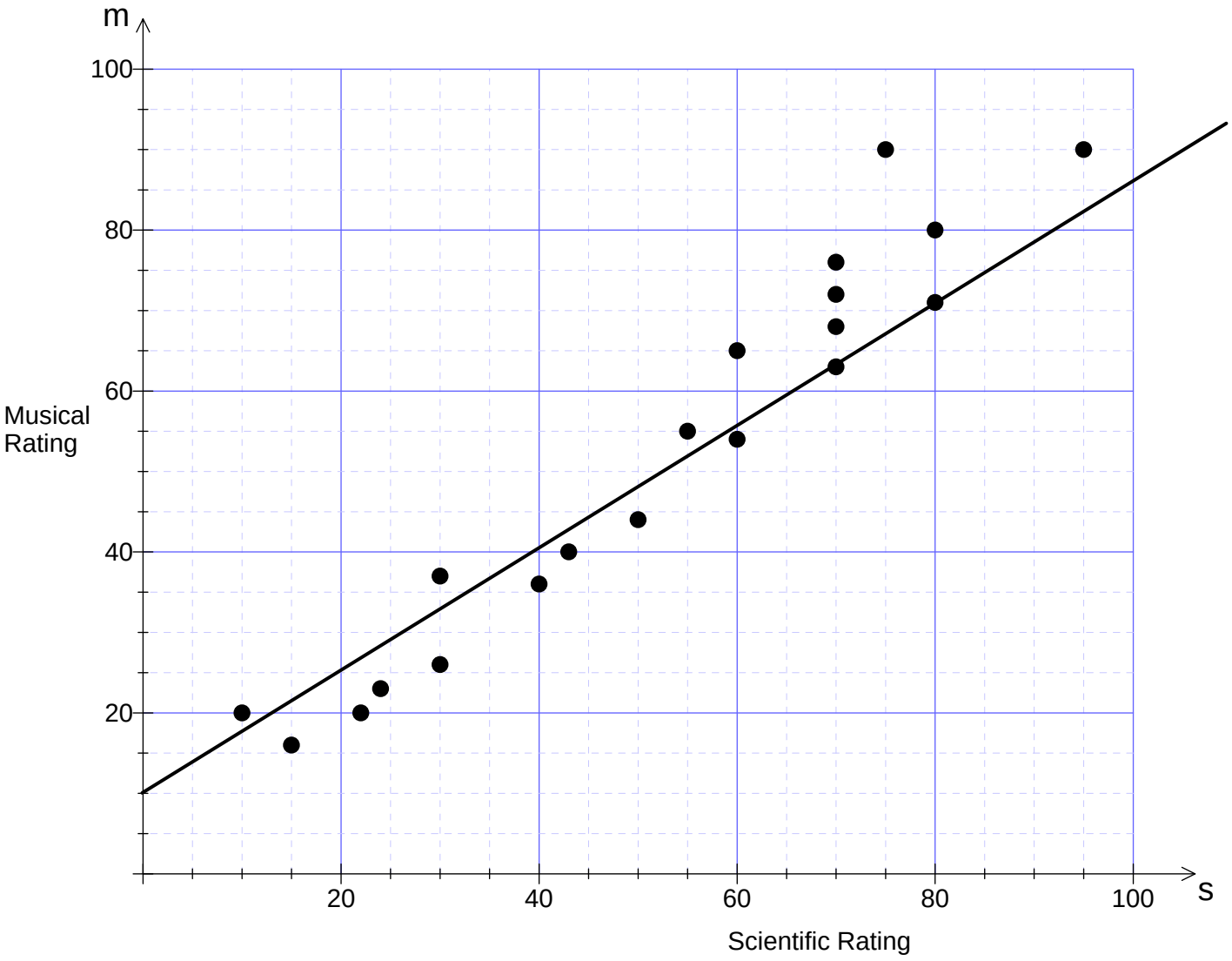
(iii) Find the length of an egg with a mass of 60 grams (correct to 1 decimal place). **1**

(c) A shield used in a school play is an elliptical prism 2 cm thick with dimensions as shown in the diagram below. It has a raised cone on its face which has a radius of 40 cm and height of 4 cm.

If the handle has a volume of 25 cm^3, and the shield is completely solid, what is the total volume of the shield, including the handle (correct to 1 decimal place). **2**



(d) Regina is doing research on the relationship between musical and scientific ability. She tested 20 students on both skills and graphed the results on a scatterplot, then drew a line of best fit.



(i) Explain why the line Regina drew is **not** a median regression line. **1**

(ii) Give the equation of the line that Regina drew. **2**

End of Trial Examination Paper

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GENERAL MATHEMATICS

FORMULAE SHEET

Area of an annulus

$A = \pi(R^2 - r^2)$

R = radius of outer circle
r = radius of inner circle

Area of an ellipse

$A = \pi ab$

a = length of semi-major axis
b = length of semi-minor axis

Area of a sector

$A = \frac{\theta}{360}\pi r^2$

θ = number of degrees in central angle

Arc length of a circle

$l = \frac{\theta}{360} 2\pi r$

θ = number of degrees in central angle

Simpson's rule for area approximation

$A \approx \frac{h}{3}(d_f + 4d_m + d_l)$

h = distance between successive measurements
d_f = first measurement
d_m = middle measurement
d_l = last measurement

Surface area

Sphere $A = 4\pi r^2$
Closed cylinder $A = 2\pi rh + 2\pi r^2$

r = radius
h = perpendicular height

Volume

Cone $V = \frac{1}{3}\pi r^2 h$
Cylinder $V = \pi r^2 h$
Pyramid $V = \frac{1}{3}Ah$
Sphere $V = \frac{4}{3}\pi r^3$

r = radius
h = perpendicular height
A = area of base

Sine rule

$\frac{a}{\sin A} = \frac{b}{\sin B} = \frac{c}{\sin C}$

Area of a triangle

$A = \frac{1}{2}ab\sin C$

Cosine rule

$c^2 = a^2 + b^2 - 2ab\cos C$

or

$\cos C = \frac{a^2 + b^2 - c^2}{2ab}$

FORMULAE SHEET

Simple interest

$I = \Pr n$

P = initial quantity

r = percentage interest rate per period, expressed as a decimal

n = number of periods

Compound interest

$A = P(1+r)^n$

A = final balance

P = initial quantity

r = percentage interest rate per compounding period, expressed as a decimal

Future value (A) of an annuity

$$A = M\left[\frac{(1+r)^n - 1}{r}\right]$$

M = contribution per period, paid at the end of the period

Present value (N) of an annuity

$$N = M\left[\frac{(1+r)^n - 1}{r(1+r)^n}\right]$$

or

$$N = \frac{A}{(1+r)^n}$$

Straight-line formula for depreciation

$S = V_0 - Dn$

S = salvage value of asset after n periods

V_0 = purchase price of the asset

D = amount of depreciation apportioned per period

n = number of periods

Declining balance formula for depreciation

$S = V_0(1-r)^n$

S = salvage value of asset after n periods

r = percentage interest rate per period, expressed as a decimal

Mean of a sample

$$\bar{x} = \frac{\sum x}{n}$$

$$\bar{x} = \frac{\sum fx}{\sum f}$$

$\bar{x}$ = mean

x = individual score

n = number of scores

f = frequency

Formula for a z-score

$$z = \frac{x - \bar{x}}{s}$$

s = standard deviation

Gradient of a straight line

$$m = \frac{\textit{vertical change in position}}{\textit{horizontal change in position}}$$

Gradient-intercept form of a straight line

$y = mx + b$

m = gradient

$b = y$ – intercept

Probability of an event

The probability of an event where outcomes are equally likely is given by:

$$\text{P(event)} = \frac{\text{number of favourable outcomes}}{\text{total number of outcomes}}$$

2010 General Maths Trial Solutions.

Multiple Choice

1. D

$386.956 = 390$ (2 significant figures)

2. A

$V = \frac{4}{3}\pi r^3$

$1000 = \frac{4}{3} \times \pi \times r^3$

$750 = \pi r^3$

$r^3 = 238.732\ldots$

$r = 6.2$ (1dp)

$1L = 1000mL$

$1mL = 1cm^3$

$1000mL = 1000cm^3$

3. D

$= 0.669707\ldots$

$= 6.7 \times 10^{-1}$

4. B

$5000 = (500 \times 4) + 150w$

$3000 = 150w$

$w = 20$

5. A

Antz	Psycho
- Mode = 26	- Mode = 15
- Range = 30	- Range = 30

6. C

$$150 = \frac{120+140+180+160+140+x}{6}$$

$900 = 740 + x$

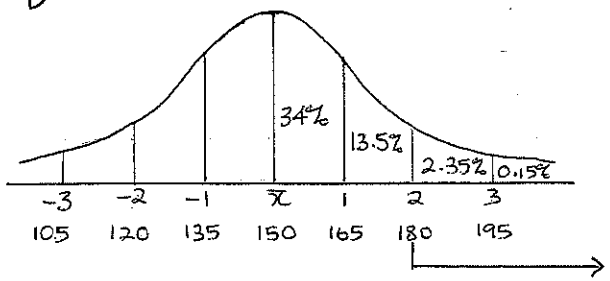
$x = 160$

7. A

8. D

Camry	$= 65 \times 11$	$= 715$ km
Commodore	$= 73 \times 8$	$= 584$ km
Falcon	$= 80 \times 7$	$= 560$ km
Magna	$= 64 \times 12$	$= 768$ km

9. D



$2.35 + 0.15 = 2.5\%$

10. B

$x^2 = 23.6^2 + 21.5^2 - 2 \times 23.6 \times 21.5 \cos 120$

$x = \sqrt{23.6^2 + 21.5^2 - 2 \times 23.6 \times 21.5 \cos 120}$

11. B

$$\frac{^{4}\cancel{12}\, a^4 b^3 \times \cancel{5}\, \cancel{a^2 b^3}^{\cancel{3}}}{\cancel{15}\, \cancel{a^2 b^3}} = 4a^4 b^3$$

12. B

taxable income $= 56\,200 - 4200$

$= \$52\,000$

income tax $= 3600 + (0.3(52000 - 30000))$

$= \$10\,200$

13. A

$$z = \frac{x - \bar{x}}{s}$$

$$2.5 = \frac{x - 58}{4.8}$$

$$12 = x - 58$$

$$x = 70$$

14. C

$$y = \frac{1}{3}x + \frac{1}{3}$$

$$y = \frac{x+1}{3}$$

15. C

$V = Ah$

$= \frac{1}{2} \times 39 \times (56 + 45) \times 30$

$= 59\,085\ cm^3$

16. A

continuous (quantitative data)

17. C

$$\frac{240}{1200} \times 100 = 20$$

18. D

$I = 4500 \times 0.1 \times 3$

$= 1350$

Total $= 4500 + 1350$

$= \$5850$

19. C

$$\frac{1}{5000} : \frac{5000}{5000}$$

$0.0002 : 1$

$\times 650 \quad \times 650$

$0.13m : 650m$

$0.13m = 13cm$

$= 130mm$

20. D

$12 - 3(2x - 2)$

$= 12 - 6x + 6$

$= 18 - 6x$

21 D

$$X = 299\,320.77 \times \frac{0.075}{12}$$

$= 1870.7548....$

$= \$1870.75$

22. B

Question 23

a) (i) $7.7530 (1)

(ii) $60\,000 \div 1000 = 60$ (1)
$\therefore$ repayment $= 60 \times 7.7530$
$= \$465.18$ (1)

(iii) total repayment $= 465.18 \times 12 \times 20$
$= \$111\,643.20$ (1)

(iv) Interest $= 111\,643.20 - 60\,000$
$= \$51\,643.20$ (2)

b) $h = 420 \therefore \frac{h}{3} = \frac{420}{3} = 140$

$A \approx [140(700 + 4 \times 505 + 420) + 140(420 + 4 \times 490 + 505)]$
$\approx 439\,600 + 403\,900$
$\approx \$843\,500\ m^2$
(1) for each Simpsons rule
(1) for addition

c) dividend yield $= \frac{2.20}{25.50} \times 100$ (1)
$= 8.62745\ldots\%$
$= 8.63\%$ (2 dp) (1)

d) $\cos\theta = \frac{16^2 + 17^2 - 18^2}{2 \times 16 \times 17}$ (2)
$\cos\theta = 0.40625$
$\theta = 66^\circ 01' 49.86''$
$= 66^\circ 02'$ (nearest minute)

Question 24

a) (i) yellow (1)

(ii) Blue and Red (1)

(iii) $\frac{11}{12}$ (1)

b) (i) $120 + 30 = 150^\circ$
$\therefore$ time difference $= 150 \div 15$
$= 10$ hours (1)
12 noon Fri @ Roy's home = 2am Fri at bro's place (1)

(ii) Fri 10pm (Bros place) = Sat 8am (Roy's place)
journey is 18 hours $\therefore$ Roy left home at 2pm Friday (1)

c) (i) March fee $= \$4 + 0.90$
$= \$4.90$

(ii) Type A fees $= 4 + 0.90 \times 2 = \$5.80$
Type B fees $= \$5$ (1)
Type C fees $= (22 - 8) \times 0.9 = \$12.60$

$\therefore$ Type B is cheaper option (1)

d) (i) $\frac{16}{45} \times 100 = 35.555\ldots$
$= 36\%$ (nearest whole no) (1)

(ii) Liberal : Labor $= 40 : 45$
$= 8 : 9$ (1)

(iii) There is a far greater proportion of males in the survey than there is in the voting population (1)

Question 25

a) (i) 600 (1)

(ii) $N = 600(1.04)^4$
$= 701.915136$
$= 702$ (1)

(iii) 4% per month (1)

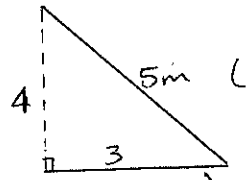
b) (i) $V = \frac{1}{3}\pi r^2 h$

$3V = \pi r^2 h$
$\frac{3V}{\pi h} = r^2$
$r = \pm\sqrt{\frac{3V}{\pi h}}$
$r = \sqrt{\frac{3V}{\pi h}}$ (negative radius impossible)

(1) some form of rearranging
(1) correct ans.

(ii) $r = \sqrt{\frac{3(200)}{\pi \times 20}}$
$= 3.09019$
$= 3.09\text{cm}$ (2dp) (1)

c)



(1)

$P = \left(\frac{1}{2} \times 2 \times \pi \times 2\right) + 10 + 13 + 5$ (2)
$= 34.2831\ldots$
$= 34.3\text{m}$ (1dp)

d) (i) $C = 120n + 80$ (1)

(ii) $1520 = 120n + 80$
$1440 = 120n$
$\therefore n = 12$ days. (1)

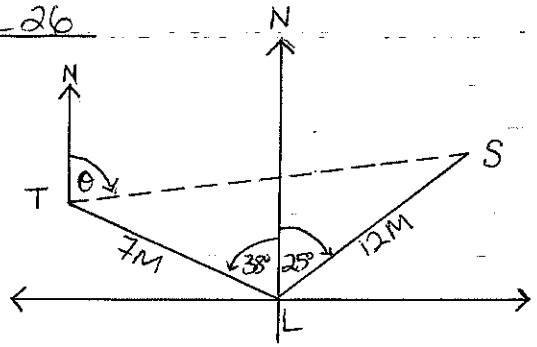
e) $\frac{2(x-1)}{3} = \frac{3x+3}{4}$
$8(x-1) = 9x + 9$
$8x - 8 = 9x + 9$
$-17 = x$
$\therefore x = -17$

(2) * full marks for correct ans.
* can solve using graphic.

(1) for some correct working

Question 26

a) (i)



(1)

(ii) $(TS)^2 = 7^2 + 12^2 - (2 \times 7 \times 12 \cos 63)$

$= 116.7295....$ (1)

$= 10.80414...$

$= 10.80\text{m}$ (2dp) (1)

(iii) $\cos \angle LTS = \dfrac{7^2 + 10.80^2 - 12^2}{2 \times 7 \times 10.80}$

$= 0.143121...$

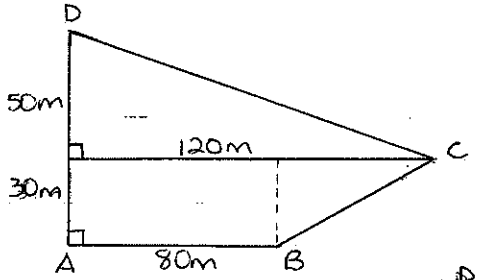
$\angle LTS = 81°46'17.31''$ (1)

$\therefore$ Bearing $\theta = 180 - 38 - 81°46'17.31''$ (co-interior $\angle$'s)

$= 60°13'42.69''$

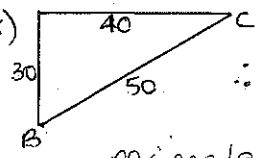
$= 60°14'$ (nearest minute) (1)

b) (i)

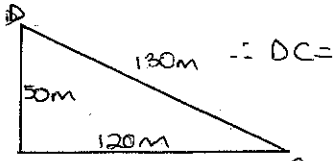


(1)

(ii) (α)



$\therefore BC = 50\text{m}$



$\therefore DC = 130\text{m}$

perimeter $= 80 + 50 + 130 + 50 + 30$

$= 340\text{m}$ (2)

(β) Sections $= 340 \div 3$

$= 113\frac{1}{3}$

$= 114$ sections needed (1)

cost $= 114 \times 25$ (1)

$= \$2850$

(iii) $A = \dfrac{30}{2}(120 + 80) + \dfrac{1}{2}(50 \times 120)$

$= 6000\text{m}^2$ (2)

(iv) $V = Ah$

$= 6000 \times 0.15$

$= 900\text{m}^3$ of concrete needed (1)

Question 27

a) (i) The Smith family used gas for heating as their costs went up considerably in winter. (1)

(ii) During May and June (1)

(iii) The Smith family has a greater mean as they have a number of larger amounts and would have a greater SD as there is greater variation between the largest and smallest values.

(2) explanation for both mean and SD.

b) (i) $X = \frac{10}{100} \times 47\,880$

$= \$4788$ (1)

$Y = 47\,880 - 4788$

$= \$43\,092$ (1)

(ii) $S = V_0(1-r)^n$

$30\,000 = 53\,200(1-0.1)^n$ (1)

$n = 5.43715...$

$= 5.4$ years

using graphics EQUA mode.

c) (i) $z = \frac{x - \bar{x}}{s}$

$= \frac{55.3 - 62.5}{3.6}$

$= -2$ (1)

(ii) $z = \frac{x - \bar{x}}{s}$

$= \frac{54.4 - 60.2}{5.8}$

$= -1$ (1)

Since 68% of scores lie within 2 scores of 1 and -1, 32% lie outside this. Hence, half of these are lower than Jason ie 16% (1)

(iii) Melissa was 2 SD below the mean while Jason was 1 SD below. Since lower times are better, Melissa performed better in relation to her gender. (1)

d) (i) Angular distance $= 32° + 43°$

$= 75°$ (1)

(ii) Distance $= 75° \times 60\text{M}$

$= 4500\text{M}$

$= 4500 \times 1.852$

$= 8\,334$ km (1)

Question 28

a) (i) Solved using graphics calculator TVM mode.

$n = 20$
$I\% = 4$
$PV = n/a$
$PMT = -800$
$FV = ?$
$P/Y = 2$
$C/Y = 2$

$\therefore FV = 19\,437.89584$
$= \$19\,437.90$ (nearest cent) (2)

(ii) Solved using graphics calculator TVM mode

$n = 20$
$I\% = 4$
$PV = ?$
$PMT = n/a$
$FV = -19\,437.90$
$P/Y = 2$
$C/Y = 2$

$\therefore PV = \$13\,081.14948$
$= \$13\,081.15$ (nearest cent) (2)

b) (i) $M = kL^3$
$84 = k \times 6^3$
$84 = 216k$
$k = \frac{7}{18}$ (1)

$\therefore M = \frac{7L^3}{18}$ (1)

(ii) $M = \frac{7 \times 5^3}{18}$ (1)
$= 48.61111...$
$= 48.6\,g$ (1dp)

(iii) $M = \frac{7L^3}{18}$
$60 = \frac{7L^3}{18}$
$1080 = 7L^3$
$L^3 = 154.2857...$
$L = 5.3634...$
$L = 5.4\,g$ (1dp) (1)

c) Area of ellipse $= \pi \times 42.5 \times 70$
$= 9346.238144\,cm^2$
Volume of ellipse prism $= 9346.238144 \times 2$
$= 18\,692.47629\,cm^3$

Volume of cone $= \frac{1}{3} \times \pi \times 40^2 \times 4$
$= 6702.064328\,cm^3$

Total Volume $= 18\,692.47629 + 6702.064328 + 25$
$= 25\,394.54062$
$= 25\,419.5\,cm^3$ (1dp)

d) (i) For a median regression line the points are broken into 3 groups (top, middle & lower) and in each group a median point is found and the line drawn relative to these. For these points, the top group of points in particular are all above (or on) the line, so it does not go through their median point. Hence, not a regression line (1)

(ii) using points (0,10) and (20, 25)

$M = \frac{\text{rise}}{\text{run}}$
$= \frac{15}{20}$
$= \frac{3}{4}$

$y = mx + b$
$y = \frac{3x}{4} + 10$

$\therefore M = \frac{3S}{4} + 10$ (2)

$b = 10$