Nova Scotia Examinations
Mathematics 12
Web Sample 2

Marking Guide

NOVA SCOTIA
Education
Evaluation Services

Teacher
Name: _____

Selected Response Answers

1. D
2. D
3. C
4. C
5. B
6. A
7. C
8. C
9. B
10. B
11. A
12. B
13. B
14. D
15. B
16. D
17. C
18. A
19. C
20. D
21. C
22. A
23. A
24. C
25. B

Question 26(a) (3 points)

0.5 pt 0.5 pt

$$\frac{1}{a}(y-7)=(x-3)^2$$

$$\frac{1}{a}(5-7)=(2-3)^2$$ 1 pt

$$\frac{-2}{a}=1$$

$$a=-2$$ 0.5 pt

$$\therefore -\frac{1}{2}(y-7)=(x-3)^2$$ 0.5 pt

To go from (7, 3) to (4, 5) there is a horizontal translation is 1 and a vertical translation of -2. If there was no vertical stretch the vertical translation should be 1, therefore the vertical stretch must be –2.

1.5 pt

$$\therefore -\frac{1}{2}(y-7)=(x-3)^2$$ 1.5 pt

OR

QuadReg on TI-83

$$y=ax^2+bx+c$$
$$a=-2$$
$$b=12$$
$$c=-11$$

1 pt

$$y=-2x^2+12x-11$$
$$y+11=-2x^2+12x$$
$$y+11=-2(x^2-6x)$$ 0.5 pt
$$y+11=-2(x^2-6x+9)+18$$ 1 pt
$$y-7=-2(x-3)^2$$
$$-\frac{1}{2}(y-7)=(x-3)^2$$ 0.5 pt

Question 26(b) (3 points)

Domain: $\{x\in\mathbb{R}\}$ or $(-\infty,\infty)$ 1 pt

Range: $\{y \mid y\le 7, y\in\mathbb{R}\}$ or $(-\infty,7]$ 1 pt

Question 27 (2 points)

$D = b^2 - 4ac$

$= (8)^2 - 4(3)(8)$ — 0.5 pt

$= 64 - 96$

$= -32$ — 0.5 pt

Since the discriminant is less than zero, the graph will have no x-intercepts. — 0.5 pt — 0.5 pt

Question 28 (a) (2 points)

Speed (km/h)	10	20	30	40	50
Crash severity index	1.20	4.40	9.60	16.80	26.00

3.2 5.2 7.2 9.2

2 2 2

1 pt

Yes Jimmy is correct because the second-level differences, D_2, are constant.

1 pt

OR

1 pt

Yes Jimmy is correct because the QuadReg on the TI-83 shows an R2 value of 1. — 1 pt

QuadReg TI-83

$y = ax2 + bx + c$

a = 0.01
b = 0.02
c = 0
$R^2 = 1$

Question 28 (b) (3 points)

$y = ax^2 + bx + c$ $c = 0$ (obtained from table) 0.5 pt

$2a(\Delta x)^2 = 2$

$2a(100) = 2$

$200a = 2$

$a = 0.01$ 0.5 pt

$(10, 1.2) \Rightarrow \quad y = 0.01x^2 + bx$

$1.2 = 0.01(10)^2 + 10b$

$1.2 = 1 + 10b$

$0.2 = 10b$

$0.02 = b$ 0.5 pt

$\therefore y = 0.01x^2 + 0.02x$

$0.01x^2 + 0.02x = 50.4$ 0.5 pt

$0.01x^2 + 0.02x - 50.4 = 0$

solve using any method to get: 0.5 pt

$x = 70$ 0.5 pt

OR

Using QuadReg on the TI-83: 0.5 pt

$y = 0.01x^2 + 0.02x$ 1 pt

OR

Table of values on TI-83 0.5 pt

x	y
60	37.2
70	50.4
80	65.6

1 pt

$0.01x^2 + 0.02x = 50.4$ 0.5 pt

$0.01x^2 + 0.02x - 50.4 = 0$

solve using any method to get: 0.5 pt

$x = 70$ 0.5 pt

OR

Speed (km/h)	10	20	30	40	50	**60**	**70**
Crash severity index	1.20	4.40	9.60	16.80	26.00	**37.20**	**50.40**

1 pt

3.2 5.2 7.2 9.2 **11.2** **13.2** 1 pt for 1st level differences

2 2 2 **2** **2**

$x = 70$ 1 pt

Question 29 (a) (3 points)

$$x = \frac{1 \pm \sqrt{(-1)^2 - (4)(1)(-6)}}{2(1)}$$ 1 pt

$$= \frac{1 \pm \sqrt{25}}{2}$$ 1 pt

$$x = \frac{1+5}{2}$$

0.5 pt $= 3$

$$x = \frac{1-5}{2}$$

$= -2$ 0.5 pt

$$x^2 - x - 6 = 0$$

$$(x-3)(x+2) = 0$$ 1 pt

0.5 pt $x - 3 = 0$

0.5 pt $x = 3$

$x + 2 = 0$ 0.5 pt

$x = -2$ 0.5 pt

OR

$$x^2 - x = 6$$

$$x^2 - x + \frac{1}{4} = 6 + \frac{1}{4}$$ 1 pt

$$\left(x - \frac{1}{2}\right)^2 = \frac{25}{4}$$ 0.5 pt

$$\sqrt{\left(x - \frac{1}{2}\right)^2} = \sqrt{\frac{25}{4}}$$

$$x - \frac{1}{2} = \pm\frac{5}{2}$$ 0.5 pt

$$x = \pm\frac{5}{2} + \frac{1}{2}$$

$$x = \frac{5}{2} + \frac{1}{2}$$

0.5 pt $= 3$

$$x = -\frac{5}{2} + \frac{1}{2}$$

$= -2$ 0.5 pt

Question 29 (b) (3 points)

$$x = \frac{-7 \pm \sqrt{(7)^2 - (4)(2)(-4)}}{2(2)}$$ 1 pt

$$= \frac{-7 \pm \sqrt{81}}{4}$$ 1 pt

$$x = \frac{-7-9}{4}$$

0.5 pt $= -4$

$$x = \frac{-7+9}{4}$$

$$= \frac{1}{2}$$ 0.5 pt

$$2x^2 + 8x - x - 4 = 0$$

$$2x(x+4) - 1(x+4) = 0$$

$$(2x-1)(x+4) = 0$$ 1 pt

0.5 pt $2x - 1 = 0$

0.5 pt $2x = 1$

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

$x + 4 = 0$ 0.5 pt

$x = -4$ 0.5 pt

OR

$$2x^2 + 7x = 4$$

$$x^2 + \frac{7}{2}x = 2$$ 1 pt

$$x^2 + \frac{7}{2}x + \frac{49}{16} = 2 + \frac{49}{16}$$ 0.5 pt

$$\left(x + \frac{7}{4}\right)^2 = \frac{81}{16}$$

$$\sqrt{\left(x + \frac{7}{4}\right)^2} = \sqrt{\frac{81}{16}}$$ 0.5 pt

$$x + \frac{7}{4} = \pm\frac{9}{4}$$

$$x = \pm\frac{9}{4} - \frac{7}{4}$$

$$x = \frac{9}{4} - \frac{7}{4}$$

$$= \frac{2}{4}$$

0.5 pt $= \frac{1}{2}$

$$x = -\frac{9}{4} - \frac{7}{4}$$

$$= -\frac{16}{4}$$

$= -4$ 0.5 pt

Question 30 (a) (3 points)

$h = -4.9t^2 + 9.8t + 1$

$= -4.9\left(t^2 - 2t\right) + 1$ — 0.5 pt

$= -4.9\left(t^2 - 2t + 1\right) + 1 + 4.9$ — 1 pt

$= -4.9(t-1)^2 + 5.9$ — 0.5 pt

The maximum height is 5.9 metres. — 1 pt

OR

$h = -4.9t^2 + 9.8t + 1$

$h - 1 = -4.9\left(t^2 - 2t\right)$ — 1 pt

$h - 1 - 4.9 = -4.9\left(t^2 - 2t + 1\right)$ — 0.5 pt

$h - 5.9 = -4.9(t-1)^2$ — 0.5 pt

$-\frac{1}{4.9}(h - 5.9) = (t-1)^2$ — 1 pt

The maximum height is 5.9 metres.

OR

$t = -\frac{b}{2a}$

$= -\frac{9.8}{2(-4.9)}$ — 1 pt

$= 1$

$h = -4.9(1)^2 + 9.8(1) + 1$ — 1 pt

$= 5.9$ — 1 pt

The maximum height is 5.9 metres.

$h = \frac{4ac - b^2}{4a}$

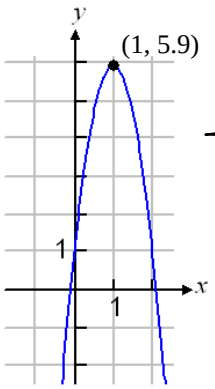
$= \frac{4(-4.9)(1) - (9.8)^2}{4(-4.9)}$ — 2 pts

$= 5.9$

The maximum height is 5.9 metres. — 1 pt

OR

$y = -4.9x^2 + 9.8x + 1$



2 pts

The maximum height is 5.9 metres. — 1 pt

Question 30(b) (3 points)

$$-4.9t^2 + 9.8t + 1 = 5$$ 1 pt

$$-4.9t^2 + 9.8t - 4 = 0$$

$$t = \frac{-9.8 \pm \sqrt{(9.8)^2 - (4)(-4.9)(-4)}}{2(-4.9)}$$ 1 pt

$$= \frac{-9.8 \pm \sqrt{17.64}}{-9.8}$$

$$t = \frac{-9.8 + 4.2}{-9.8} \qquad t = \frac{-9.8 - 4.2}{-9.8}$$

$$t \doteq 0.57 \qquad \doteq 1.43$$

0.5 pt 0.5 pt

OR

$$-4.9t^2 + 9.8t = 4$$

$$t^2 - 2t \doteq -0.8163$$

$$t^2 - 2t + 1 \doteq 0.1837$$ 0.5 pt

$$(t-1)^2 \doteq 0.1837$$

$$\sqrt{(t-1)^2} \doteq \sqrt{0.1837}$$

$$t - 1 \doteq \pm 0.4286$$ 0.5 pt

$$t \doteq -0.4286 + 1 \qquad t \doteq 0.4286 + 1$$

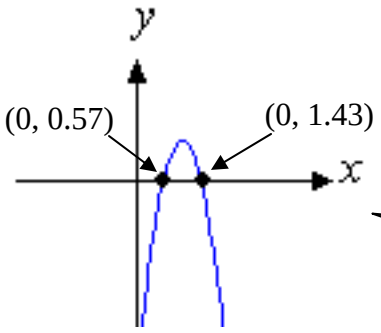
$$t \doteq 0.57 \qquad t \doteq 1.43$$

0.5 pt 0.5 pt

The ball will be at 5 m at 0.57 s and at 1.43 s.

OR

$$y = -4.9t^2 + 9.8t - 4$$ 1 pt



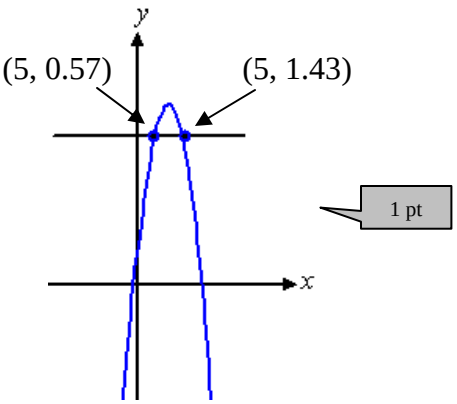
1 pt

The ball will be at 5 m at 0.57 s and at 1.43 s.

0.5 pt 0.5 pt

$$y_1 = -4.9t^2 + 9.8t + 1$$ 1 pt

$$y_2 = 5$$

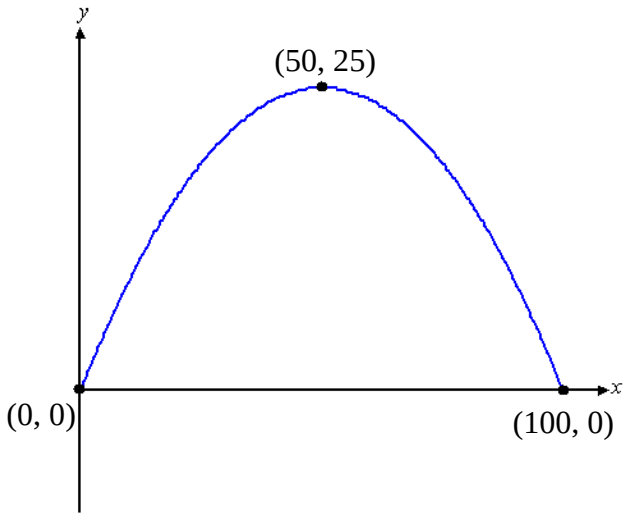


1 pt

The ball will be at 5 m at 0.57 s and at 1.43 s.

0.5 pt 0.5 pt

Question 31 (4 points)



0.5 pt for each of the following:

- ✓ the graph has a parabolic form, opens downward and axes are labeled.
- ✓ Passes through point (0, 0) and point is labeled.
- ✓ Passes through (100, 0) and point is labeled.
- ✓ Vertex identified and labeled at (50, 25)

Question 31(b) (4 points)

$$y = a(x-50)^2 + 25$$ 1 pt

$$(0,\ 0) \Rightarrow 0 = a(0-50)^2 + 25$$ 0.5 pt

$$-25 = 2500a$$

$$-0.01 = a$$ 0.5 pt

$$y = -0.01(x-50)^2 + 25$$

$$= -0.01(20-50)^2 + 25$$ 1 pt

$$= 16$$ 1 pt

The ball will be at a height of 16 m at a horizontal distance of 20 m.

Question 32 (a) (3 points)

$$\left(3^2\right)^{x+2} = \left(3^3\right)^{3x+1}$$ 1 pt

$$3^{2x+4} = 3^{9x+3}$$ 0.5 pt

$$\therefore 2x+4 = 9x+3$$ 1 pt

$$-7x = -1$$

$$x = \frac{1}{7}$$ 0.5 pt

$$(x+2)\log 9 = (3x+1)\log 27$$ 1 pt

$$x+2 = \frac{(3x+1)\log 27}{\log 9}$$ 1 pt

$$x+2 = (3x+1)(1.5)$$

$$x+2 = 4.5x+1.5$$

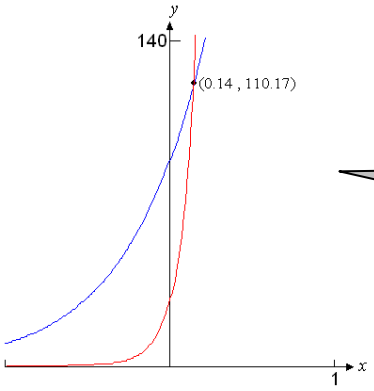
$$-3.5x = -0.5$$

$$x = \frac{1}{7}$$ 1 pt

OR

$$y_1 = 9^{x+2}$$

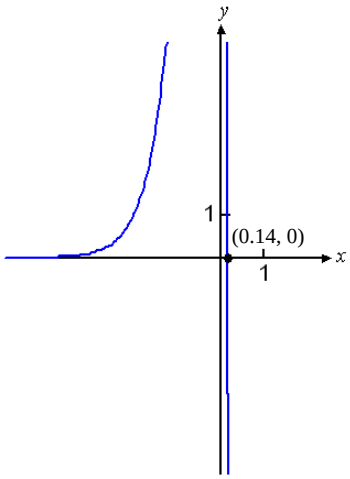
$$y_2 = 27^{3x+1}$$ 1 pt



1 pt

$$\therefore x = 0.14$$ 1 pt

$$y = 9^{x+2} - 27^{3x+1}$$ 1 pt



1 pt

$$\therefore x = 0.14$$ 1 pt

Question 32 (b) (3 points)

$\log 2^{3x-1} = \log 17$ 1 pt

$3x-1 = \dfrac{\log 17}{\log 2}$ 0.5 pt

$3x-1 \doteq 4.0875$ 0.5 pt

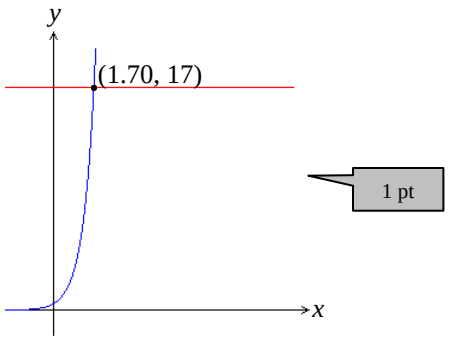
$3x \doteq 5.0875$

$x \doteq 1.70$ 1 pt

OR

$y_1 = 2^{3x-1}$

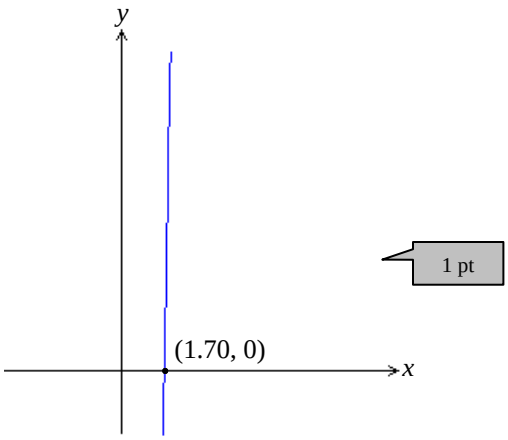
$y_2 = 17$ 1 pt



1 pt

$\therefore x = 1.70$ 1 pt

$y = 2^{3x-1} - 17$ 1 pt



1 pt

$\therefore x = 1.70$ 1 pt

Question 32 (c) (3 points)

$\log_5(2x \cdot 10) = 4$ 1 pt

$\log_5 20x = 4$ 0.5 pt

$20x = 5^4$ 1 pt

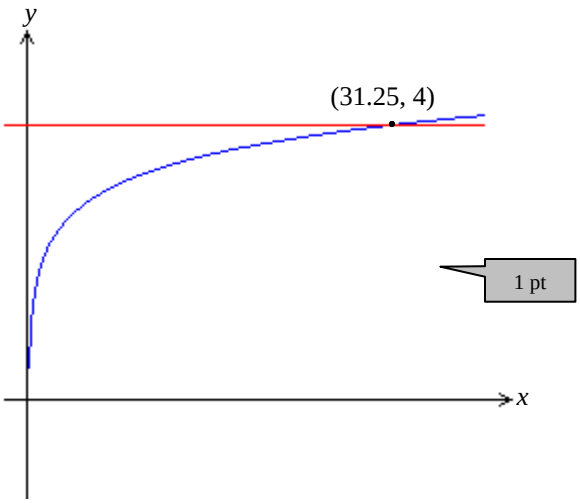
$20x = 625$

$x = 31.25$ 0.5 pt

OR

$y_1 = \log_5 2x + \log_5 10$ 1 pt

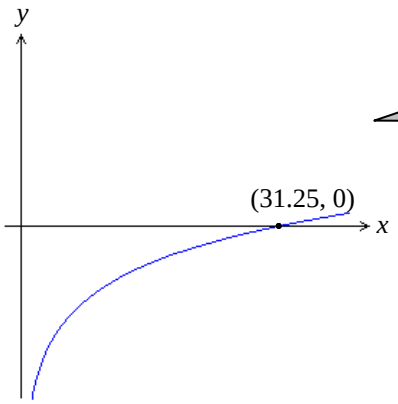
$y_2 = 4$



1 pt

$\therefore x = 31.25$ 1 pt

$y = \log_5 2x + \log_5 10 - 4$ 1 pt



1 pt

$\therefore x = 31.25$ 1 pt

Question 33 (a) (1 point)

$(0,\ 4.5)$ 1 pt

Question 33 (b) (1 point)

$y = 4$ 1 pt

Question 33 (c) (2 points)

It is a growth curve. 1 pt

The function is of the form $y = ab^x + c$, which is a growth curve if $a > 0$ and $b > 1$. 1 pt

Question 34 (3 points)

$\log 2x + 3\left(\log \frac{y}{z}\right)$ 1 pt

$\log 2x + \log\left(\frac{y^3}{z^3}\right)$ 1 pt

$\log\left(\frac{2xy^3}{z^3}\right)$ 1 pt

OR

$\log 2x + 3\log y - 3\log z$ 0.5 pt

$\log 2x + \log y^3 - \log z^3$ 0.5 pt

$\log 2xy^3 - \log z^3$ 1 pt

$\log\left(\frac{2xy^3}{z^3}\right)$ 1 pt

Question 35(a) (2 points)

(i) 3 1 pt

(ii) 3 1 pt

Question 35(b) (2 points)

(i) 2 1 pt

(ii) 2 1 pt

Question 35(c) (1 point)

$-\log_{\frac{1}{b}} N = \log_b N$ 1 pt

Question 36 (2 points)

$$0^{-3} = \frac{1}{0^3} = \frac{1}{0}$$ 1 pt

Division by 0 is undefined. 1 pt

Question 37 (3 points)

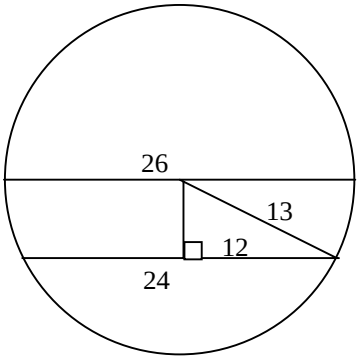
- ✓ Initial amount of 1000 1 pt
- ✓ Doubles 1 pt
- ✓ Doubling period is 5 units of time 1 pt

Examples:

A $1000 investment doubles every 5 years.

The number of bacteria starts at 1000 and doubles every 5 hours.

Question 38 (3 points)



$h^2 = x^2 + y^2$

$13^2 = 12^2 + y^2$ 1 pt

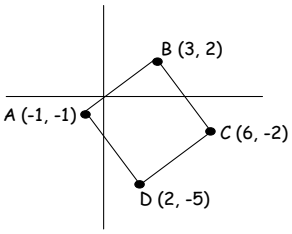
$169 = 144 + y^2$ 0.5 pt

$25 = y^2$ 0.5 pt

$5 = y$ 1 pt

The chord is 5 cm from the centre.

Question 39(a) (2 points)



$D_{\overline{AC}} = \sqrt{\left(6-\left(-1\right)\right)^2 + \left(-2-\left(-1\right)\right)^2}$ 0.5 pt

$= \sqrt{49+1}$

$= \sqrt{50}$ 0.5 pt

$= 5\sqrt{2}$

$D_{\overline{BD}} = \sqrt{\left(3-2\right)^2 + \left(2-\left(-5\right)\right)^2}$ 0.5 pt

$= \sqrt{1+49}$

$= \sqrt{50}$ 0.5 pt

$= 5\sqrt{2}$

Question 39(b) (3 points)

Midpoint of $\overline{AC} = \left(\frac{-1+6}{2}, \frac{-1+\left(-2\right)}{2}\right)$

$= \left(\frac{5}{2}, \frac{-3}{2}\right)$ 1 pt

Midpoint of $\overline{BD} = \left(\frac{3+2}{2}, \frac{2+\left(-5\right)}{2}\right)$

$= \left(\frac{5}{2}, \frac{-3}{2}\right)$ 1 pt

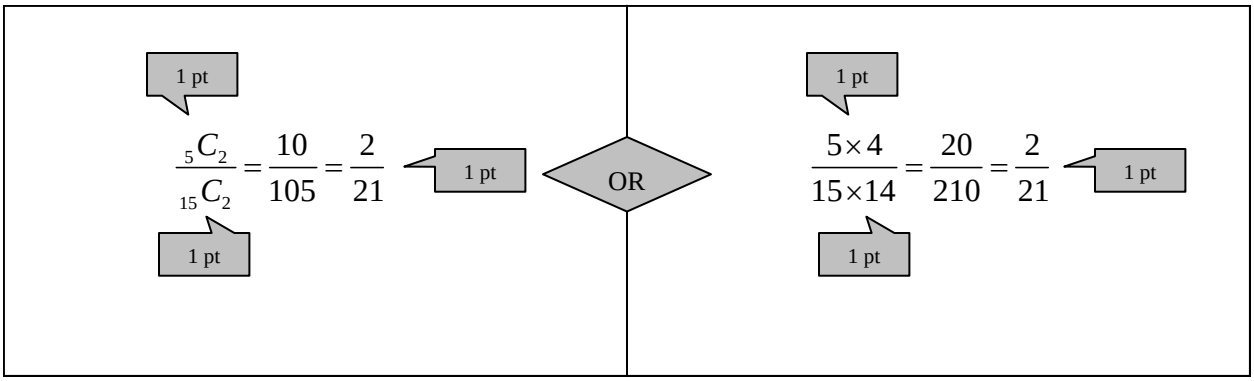
Since the diagonals have the same midpoint, they bisect each other. 1 pt

Question 40 (1 point)

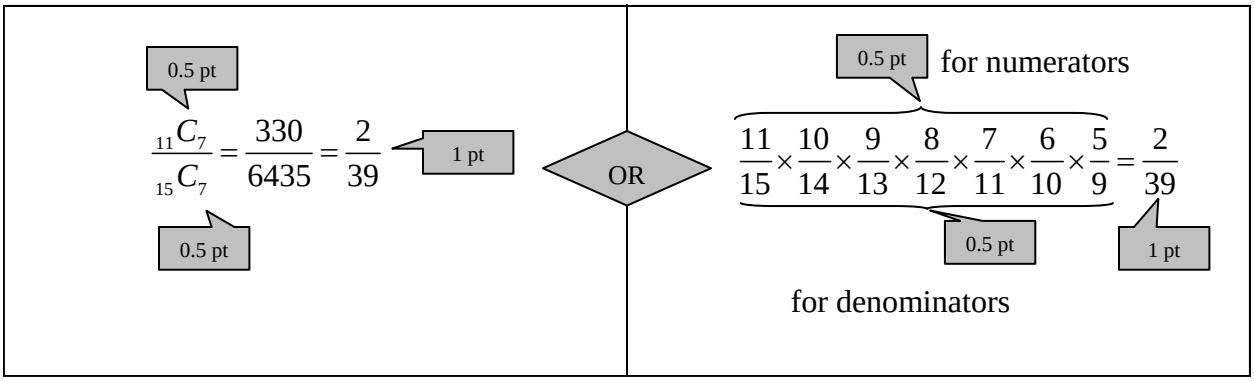
Some examples:

- ✓ If a quadrilateral is a rhombus, then the diagonals are perpendicular.
- ✓ If a quadrilateral is a square, the diagonals are congruent.
- ✓ If you have a million dollars, then you are rich.

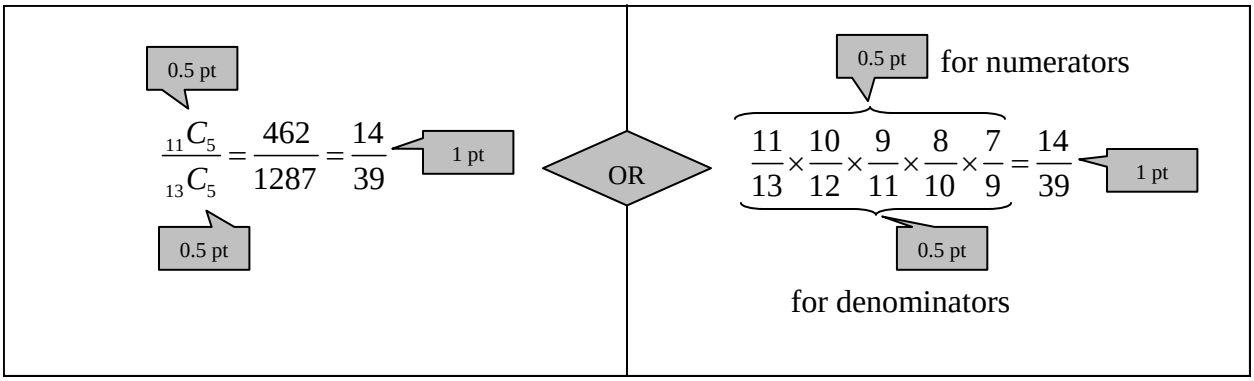
Question 41 (3 points)



Question 42(a) (2 points)



Question 42(b) (2 points)



Question 43 (3 points)

Examples:

- ✓ What is the probability of being 6'3" or left handed?
- ✓ What is the probability of becoming a teacher or a mother?
- ✓ What is the probability of being over 30 and having O positive blood?