



**Nova Scotia Examinations
Mathematics 12
Web Sample 1**

Marking Guide

Selected Response Answers

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

Question 26 (a)

(3 points)

$y = -3x^2 + 12x + 6$ $x = \frac{-b}{2a}$ $= \frac{-12}{(2)(-3)}$ $= \frac{-12}{-6}$ $= 2$	$f(2) = -3x^2 + 12x + 6$ $= -3(2)^2 + 12(2) + 6$ $= -12 + 24 + 6$ $= 18$
<div style="border: 1px solid black; width: 40px; height: 20px; margin: 0 auto; transform: rotate(45deg); display: flex; align-items: center; justify-content: center;">OR</div>	
$y = -3x^2 + 12x + 6$ $y = -3(x^2 - 4x - 2)$ $y = -3(x^2 - 4x - 2 + 6 - 6)$ $y = -3(x - 2)^2 + 18$ $-\frac{1}{3}(y - 18) = (x - 2)^2$	
<p>Note: Last step may be omitted and then the final answer gets a 1 pt value.</p>	
<p>The coordinates of the vertex are (2, 18).</p>	

Question 26 (b)

(1 point)

0.5 pt

The vertex is a maximum point because:

- the 'a' value is negative
- graphing the function $y = -3x^2 + 12x + 6$ shows it is a maximum. (with accompanying sketch)
- values for 'y' decrease for 'x' values on either side of the vertex.
- any other correct explanation

} 0.5 pt

Question 27 (a)

(3 points)

<div style="display: flex; justify-content: space-between; margin-bottom: 10px;"> <div style="border: 1px solid gray; padding: 2px 5px; font-size: 0.8em;">0.5 pt</div> <div style="border: 1px solid gray; padding: 2px 5px; font-size: 0.8em;">0.5 pt</div> </div> $\frac{1}{a}(y + 4.5) = (x + 2)^2$ $\frac{1}{a}(0 + 4.5) = (1 + 2)^2$ <div style="text-align: right; margin-right: 20px; font-size: 0.8em;">1 pt</div> $\frac{4.5}{a} = 9$ $a = \frac{4.5}{9}$ $a = \frac{1}{2}$ <div style="text-align: right; margin-right: 20px; font-size: 0.8em;">0.5 pt</div> <div style="display: flex; justify-content: space-between; align-items: center; margin-top: 20px;"> <div style="text-align: center;"> \therefore $2(y + 4.5) = (x + 2)^2$ </div> <div style="font-size: 2em;">}</div> <div style="text-align: center;"> <div style="border: 1px solid gray; padding: 2px 5px; font-size: 0.8em;">OR</div> $\frac{1}{\frac{1}{2}}(y + 4.5) = (x + 2)^2$ </div> <div style="font-size: 2em;">}</div> <div style="text-align: center;"> <div style="border: 1px solid gray; padding: 2px 5px; font-size: 0.8em;">0.5 pt</div> </div> </div>	<p>To go from $(-2, -4.4)$ there is a horizontal translation is 3 and a vertical translation of 4.5. If there was no vertical stretch the vertical translation should be 9, therefore the vertical stretch must be $\frac{1}{2}$.</p> <div style="text-align: center; margin-top: 10px;"> <div style="border: 1px solid gray; padding: 2px 5px; font-size: 0.8em;">1.5 pt</div> </div> <div style="display: flex; justify-content: space-between; align-items: center; margin-top: 20px;"> <div style="text-align: center;"> \therefore $2(y + 4.5) = (x + 2)^2$ </div> <div style="font-size: 2em;">}</div> <div style="text-align: center;"> <div style="border: 1px solid gray; padding: 2px 5px; font-size: 0.8em;">OR</div> $\frac{1}{\frac{1}{2}}(y + 4.5) = (x + 2)^2$ </div> <div style="font-size: 2em;">}</div> <div style="text-align: center;"> <div style="border: 1px solid gray; padding: 2px 5px; font-size: 0.8em;">1.5 pt</div> </div> </div>
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Question 27 (b)

(2.5 points)

<div style="display: flex; align-items: center;"> <div style="border: 1px solid gray; padding: 2px 5px; font-size: 0.8em; margin-right: 10px;">0.5 pt</div> </div>	<p>Award 0.5 pt for a correctly drawn parabola passing through the vertex and the correct x-intercepts.</p> <p>Award 0.5 pt for each of the 3 other points labeled on the parabola.</p>
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Question 28 (a)

(3 points)

$$x = \frac{-3 \pm \sqrt{(3)^2 - (4)(5)(-7)}}{2(5)} \quad \text{1 pt}$$
$$= \frac{-3 \pm \sqrt{149}}{10} \quad \text{1 pt}$$

$$x = \frac{3 + \sqrt{149}}{10} \quad \text{0.5 pt}$$
$$x = \frac{3 - \sqrt{149}}{10} \quad \text{0.5 pt}$$

Question 28 (b)

(3.5 points)

$$6x^2 + 2x - 3x = 3 + 12x - 4x^2$$
$$10x^2 - 13x - 3 = 0 \quad \text{0.5 pt}$$

$$x = \frac{13 \pm \sqrt{(13)^2 - (4)(10)(-3)}}{2(10)} \quad \text{1 pt}$$
$$= \frac{13 \pm \sqrt{289}}{20} \quad \text{1 pt}$$

$$x = \frac{13+17}{20} = \frac{3}{2} \quad \text{0.5 pt}$$
$$x = \frac{13-17}{20} = -\frac{1}{5} \quad \text{0.5 pt}$$

OR

$$10x^2 - 15x - 3 = 0$$
$$5x(2x-3) + 1(2x-3) = 0$$
$$(5x+1)(2x-3) = 0 \quad \text{1 pt}$$

$$5x+1 = 0 \quad \text{0.5 pt}$$
$$x = -\frac{1}{5} \quad \text{0.5 pt}$$
$$2x-3 = 0 \quad \text{0.5 pt}$$
$$x = \frac{3}{2} \quad \text{0.5 pt}$$

Question 29(a)

(3 points)

$$\begin{aligned}
 h &= -4.9t^2 + 20t + 1.8 && \text{0.5 pt} \\
 &= -4.9(t^2 - 4.0816t) + 1.8 && \text{0.5 pt} \quad \text{1 pt} \\
 &= -4.9(t^2 - 4.0816t + 4.1649) + 1.8 + 20.4078 \\
 &= -4.9(t - 2.0408)^2 + 22.2078
 \end{aligned}$$

The maximum height is 22.21 metres. 1 pt

OR

$$\begin{aligned}
 -\frac{1}{4.9}h &= t^2 - 4.0816t - 0.3673 && \text{0.5 pt} \\
 -\frac{1}{4.9}h + 0.3673 + 4.1649 &= t^2 - 4.0816t + 4.1649 && \text{1 pt} \\
 -\frac{1}{4.9}h + 4.5322 &= (t - 2.0408)^2 \\
 -\frac{1}{4.9}(h - 22.2078) &= (t - 2.0408)^2
 \end{aligned}$$

0.5 pt

The maximum height is 22.21 metres. 1 pt

OR

$$\left. \begin{aligned}
 t &= -\frac{b}{2a} \\
 &= -\frac{20}{2(-4.9)} \\
 &\doteq 2.0408
 \end{aligned} \right\} \text{1 pt}$$

$$\begin{aligned}
 h &\doteq -4.9(2.0408)^2 + 20(2.0408) + 1.8 \\
 &\doteq 22.21
 \end{aligned}$$

1 pt

1 pt

The maximum height is 22.21 metres.

$$\left. \begin{aligned}
 h &= \frac{4ac - b^2}{4a} \\
 &= \frac{4(-4.9)(1.8) - (20)^2}{4(-4.9)} \\
 &\doteq 22.21
 \end{aligned} \right\} \text{2 pt}$$

The maximum height is 22.21 metres.

1 pt

Question 29(b)

(2 points)

Note: $2 \times 2.04 = 4.08$ is not an acceptable answer.

$$t = \frac{-20 \pm \sqrt{(20)^2 - 4(-4.9)(1.8)}}{2(-4.9)}$$

$$= \frac{-20 \pm \sqrt{435.28}}{-9.8}$$

1 pt

$$t = \cancel{-0.09} \quad t = 4.17$$

1 pt

The snowball is in the air for 4.17 seconds.

$$-\frac{1}{4.9}(0 - 22.2078) = (t - 2.0408)^2$$

$$4.5322 = (t - 2.0408)^2$$

$$\pm 2.1289 = t - 2.0408$$

$$t = 2.0408 \pm 2.1289$$

1 pt

$$t = 4.17 \quad t = \cancel{-0.09}$$

The snowball is in the air for 4.17 seconds.

1 pt

Note: Deduct 0.5 pt if -0.09 is not discarded.

OR

$$-4.9(t - 2.0408)^2 + 22.2078 = 0$$

$$-4.9(t - 2.0408)^2 = -22.2078$$

$$(t - 2.0408)^2 = 4.5322$$

$$t - 2.0408 = \pm 2.1289$$

$$t = \pm 2.1289 + 2.0408$$

$$t = 4.17 \quad t = \cancel{-0.09}$$

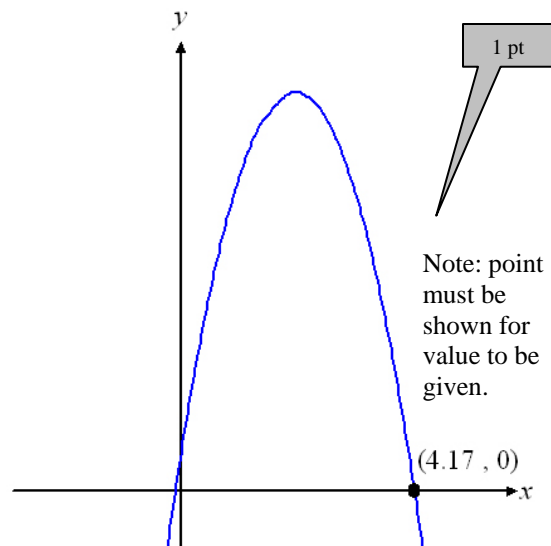
1 pt

1 pt

The snowball is in the air for 4.17 seconds.

Note: Deduct 0.5 pt if -0.09 is not discarded.

$$y_1 = -4.9x^2 + 20x + 1.8$$



1 pt

1 pt

The snowball is in the air for 4.17 seconds.

Question 30

(4 points)

$(x + 20)(x + 25) = 644$ (0.5 pt) (0.5 pt) (0.5 pt)

$x^2 + 45x + 500 = 644$

$x^2 + 45x - 144 = 0$ (1 pt)

$(x + 48)(x - 3) = 0$ (1 pt)

$x + 48 = 0$
 $x = \cancel{-48}$

$x - 3 = 0$
 $x = 3$ (0.5 pt)

OR

$x = \frac{-45 \pm \sqrt{(45)^2 - 4(1)(-144)}}{2(1)}$

$= \frac{-45 \pm \sqrt{2601}}{2}$

$= \frac{-45 \pm 51}{2}$

$x = 3$ (0.5 pt) $x = \cancel{-48}$ (0.5 pt)

The width of the strip is 3 m.

Note: Deduct 0.5 pt if -48 is not discarded.

Question 31

(5 points)

$y = a(x - 10)^2 + 18$ (1 pt)

$(0, 1.5) \Rightarrow 1.5 = a(0 - 10)^2 + 18$ (0.5 pt)

$-16.5 = 100a$

$-0.165 = a$ (0.5 pt)

$y = -0.165(x - 10)^2 + 18$

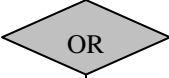
$= -0.165(19.8 - 10)^2 + 18$ (1 pt)

$= 2.15$ (1 pt)

2.15 m > 1.8 m therefore the football will not hit Tom. (1 pt)

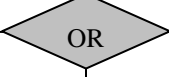
Question 32 (a)

(2 points)

$(5^2)^{x+2} = (5^3)^{2x} \quad \text{0.5 pt}$ $5^{2x+4} = 5^{6x} \quad \text{0.5 pt}$ $\therefore 2x+4 = 6x \quad \text{0.5 pt}$ $4 = 4x$ $1 = x \quad \text{0.5 pt}$		$\log 25^{x+2} = \log 125^{2x} \quad \text{0.5 pt}$ $(x+2)\log 25 = 2x\log 125 \quad \text{0.5 pt}$ $x+2 = 2x \frac{\log 125}{25}$ $x+2 = 2x(1.5) \quad \text{0.5 pt}$ $x+2 = 3x$ $2 = 2x$ $1 = x$
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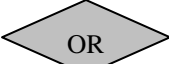
Question 32 (b)

(2 points)

$2^{x+3} = 15 \quad \text{0.5 pt}$ $\log 2^{x+3} = \log 15 \quad \text{0.5 pt}$ $(x+3)\log 2 = \log 15 \quad \text{0.5 pt}$ $x+3 = \frac{\log 15}{\log 2}$ $x \doteq -3 + 3.9069$ $x \doteq 0.91 \quad \text{0.5 pt}$		$2^{x+3} = 15 \quad \text{0.5 pt}$ $\log_2 15 = x+3 \quad \text{0.5 pt}$ $3.9069 \doteq x+3 \quad \text{0.5 pt}$ $0.91 \doteq x \quad \text{0.5 pt}$
$(2^3)(2^{x+3}) = 120 \quad \text{0.5 pt}$ $2^{x+6} = 120 \quad \text{0.5 pt}$ $(x+6)\log 2 = \log 120 \quad \text{0.5 pt}$ $x+6 = \frac{\log 120}{\log 2}$ $x \doteq -6 + 6.9069$ $x \doteq 0.91 \quad \text{0.5 pt}$	$(2^3)(2^{x+3}) = 120$ $2^{x+6} = 120 \quad \text{0.5 pt}$ $\log_2 120 = x+6 \quad \text{0.5 pt}$ $6.9069 \doteq x+6 \quad \text{0.5 pt}$ $0.91 \doteq x \quad \text{0.5 pt}$	

Question 32 (c)

(2 points)

$\log_2 30x = \log_3 81$ 0.5 pt $\log_2 30x = 4$ 0.5 pt $2^4 = 30x$ 0.5 pt $16 = 30x$ $\frac{8}{15} = x$ 0.5 pt		$\log_2 30x = \log_3 81$ 0.5 pt $\log_2 30x = 4$ 0.5 pt $\log_2 30x = \log_2 16$ 0.5 pt $30x = 16$ $x = \frac{8}{15}$ 0.5 pt
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Question 33 (a)

(1 point)

$$P = P_0 (2)^{\frac{t}{2}}$$

$$100 = P_0 (2)^{\frac{4}{2}}$$
 0.5 pt

$$100 = 4P_0$$

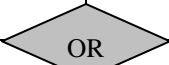
$$25 = P_0$$
 0.5 pt

Note: answer only is worth full value.

The initial number of bacteria in the culture was 25.

Question 33 (b)

(1.5 points)

$P = 25(2)^{\frac{t}{2}}$ 0.5 pt 		$y = 25(1.41)^x$ 0.5 pt
$y = a(b)^x$ $a = 25$	$(4, 100) \Rightarrow 100 = 25(b)^4$ 0.5 pt $4 = b^4$ $\sqrt[4]{4} = b$ $1.41 \doteq b$ 0.5 pt	$y = 25(1.41)^x$ 0.5 pt

Question 33 (c)

(1 point)

$y = 25(1.41)^x$ $= 25(1.41)^{20}$ <div style="text-align: right; margin-right: 20px;">0.5 pt</div> $\doteq 24117$ <div style="text-align: right; margin-right: 20px;">0.5 pt</div> <p>There are approximately 24117 bacteria after 20 hours.</p>		$y = 25(2)^{\frac{x}{2}}$ $y = 25(2)^{\frac{20}{2}}$ <div style="text-align: right; margin-right: 20px;">0.5 pt</div> $y = 25(2)^{10}$ $y = 25600$ <div style="text-align: right; margin-right: 20px;">0.5 pt</div> <p>There are approximately 25600 bacteria after 20 hours.</p>
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Question 34

(4 points)

<div style="text-align: right; margin-right: 20px;">0.5 pt</div> <div style="text-align: right; margin-right: 20px;">0.5 pt</div> <div style="text-align: right; margin-right: 20px;">0.5 pt</div> $900 = 300(1.04)^t$ $3 = 1.04^t$ <div style="text-align: right; margin-right: 20px;">0.5 pt</div> $\log_{1.04} 3 = t$ <div style="text-align: right; margin-right: 20px;">1 pt</div> $28.01 \doteq t$ <div style="text-align: right; margin-right: 20px;">1 pt</div> <p>It will take 28.01 yrs for the price to triple.</p>		<div style="text-align: right; margin-right: 20px;">0.5 pt</div> <div style="text-align: right; margin-right: 20px;">0.5 pt</div> <div style="text-align: right; margin-right: 20px;">0.5 pt</div> $900 = 300(1.04)^t$ $3 = 1.04^t$ <div style="text-align: right; margin-right: 20px;">0.5 pt</div> $\log 3 = t \log 1.04$ <div style="text-align: right; margin-right: 20px;">1 pt</div> $\frac{\log 3}{\log 1.04} = t$ $28.01 \doteq t$ <div style="text-align: right; margin-right: 20px;">1 pt</div> <p>It will take 28.01 yrs for the price to triple.</p>
<div style="text-align: right; margin-right: 20px;">0.5 pt</div> <div style="text-align: right; margin-right: 20px;">0.5 pt</div> <div style="text-align: right; margin-right: 20px;">0.5 pt</div> $3C = C(1.04)^t$ $3 = 1.04^t$ <div style="text-align: right; margin-right: 20px;">0.5 pt</div> $\log_{1.04} 3 = t$ <div style="text-align: right; margin-right: 20px;">1 pt</div> $28.01 \doteq t$ <div style="text-align: right; margin-right: 20px;">1 pt</div> <p>It will take 28.01 yrs for the price to triple.</p>		<div style="text-align: right; margin-right: 20px;">0.5 pt</div> <div style="text-align: right; margin-right: 20px;">0.5 pt</div> <div style="text-align: right; margin-right: 20px;">0.5 pt</div> $3C = C(1.04)^t$ $3 = 1.04^t$ <div style="text-align: right; margin-right: 20px;">0.5 pt</div> $\log 3 = t \log 1.04$ <div style="text-align: right; margin-right: 20px;">1 pt</div> $\frac{\log 3}{\log 1.04} = t$ $28.01 \doteq t$ <div style="text-align: right; margin-right: 20px;">1 pt</div> <p>It will take 28.01 yrs for the price to triple.</p>

Question 35 (a)

(3 points)

Note: The answers must refer to the graphs and NOT the equations.

Here are some examples:

- same y-intercept
- when $y = b^x$ is increasing, $y = b^{-x}$ is decreasing
- each is a reflection of the other in $x = 0$
- same horizontal asymptotes
- neither have x -intercepts

Question 35 (b)

(2 points)

$$\underbrace{a > 0}_{1 \text{ pt}} \quad \text{and} \quad \underbrace{b > 1}_{1 \text{ pt}}$$

Question 36

(2 points)

$$\log_2(-3) = x \quad 2^x \text{ is always positive therefore it cannot equal } -3.$$
$$2^x = -3$$

OR

The domain of $y = \log_a x$ is $x > 0, x \in \mathbb{R}$.

OR

Susan has her calculator set to give only real number answers.

Question 37

(5 points)

<p>Drug 1</p> $M = 200(0.8)^{\frac{d}{5}}$ $= 200(0.8)^{\frac{12}{5}}$ $= 117.07$	<p>Drug 2</p> $M = 150(0.9)^{\frac{d}{7}}$ $= 150(0.9)^{\frac{12}{7}}$ $= 125.21$
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Drug 2 has a greater amount remaining after 12 days.

Question 38

(4 points)

1 pt

$$15^2 = 9^2 + x^2$$
$$15^2 - 9^2 = x^2$$
$$144 = x^2$$
$$12 = x$$

1 pt

The length of the chord is 24 cm.

1 pt

Question 39(a)

(5 points)

Midpoint of $\overline{AB} = \left(\frac{2+8}{2}, \frac{11+(-7)}{2} \right)$ 0.5 pt
 $= (5, 2)$ 0.5 pt

$m_{\overline{AB}} = \frac{11 - (-7)}{2 - 8}$ 0.5 pt
 $= \frac{18}{-6}$
 $= -3$ 0.5 pt

\therefore slope of \perp bisector is $\frac{1}{3}$ 1 pt

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

$(5, 2) \Rightarrow 2 = \frac{1}{3}(5) + b$ 0.5 pt
 $6 = 5 + 3b$
 $1 = 3b$
 $\frac{1}{3} = b$ 0.5 pt

The equation of the perpendicular bisector
is $y = \frac{1}{3}x + \frac{1}{3}$. 1 pt

Question 39(b)

(1 point)

$(-4, -2) \Rightarrow \left. \begin{aligned} -2 &\stackrel{?}{=} \frac{1}{3}(-4) + \frac{1}{3} \\ -2 &\stackrel{?}{=} \frac{-4}{3} + \frac{1}{3} \\ -2 &\neq 1 \end{aligned} \right\}$ 0.5 pt

The point is not on the line since it does not satisfy the equation of the perpendicular bisector. 0.5 pt

Question 40

(4 points)

$d_{\overline{XY}} = \sqrt{(4-3)^2 + (-1-4)^2}$ <p style="text-align: right; margin-right: 20px;">0.5 pt</p> $= \sqrt{1+25}$ $= \sqrt{26}$ <p style="text-align: right; margin-right: 20px;">0.5 pt</p>	$d_{\overline{XZ}} = \sqrt{(3+1)^2 + (4+2)^2}$ <p style="text-align: right; margin-right: 20px;">0.5 pt</p> $= \sqrt{16+36}$ $= \sqrt{52}$ <p style="text-align: right; margin-right: 20px;">0.5 pt</p>
$d_{\overline{YZ}} = \sqrt{(4+1)^2 + (-1+2)^2}$ <p style="text-align: right; margin-right: 20px;">0.5 pt</p> $= \sqrt{25+1}$ $= \sqrt{26}$ <p style="text-align: right; margin-right: 20px;">0.5 pt</p>	<p>$\triangle XYZ$ has only 2 equal sides \therefore it is isosceles and not equilateral.</p> <p style="text-align: right; margin-right: 20px;">1 pt</p>

Question 41

(2.5 points)

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

0.5 pt 0.5 pt 1 pt

$$= \frac{13}{52} + \frac{4}{52} - \frac{1}{52}$$
$$= \frac{16}{52} \text{ or } \doteq 0.31$$

0.5 pt

Question 42

(3.5 points)

$$= \frac{{}_5C_3 \times {}_6C_3}{{}_{11}C_6}$$

1 pt 1 pt 1 pt

$$= \frac{10 \times 20}{462}$$
$$= \frac{200}{462} \text{ or } \doteq 0.43$$

0.5 pt

Question 43

(2 points)

<p>1 pt \rightarrow $\frac{1}{{}_7P_3} = \frac{1}{210}$ \leftarrow 1 pt</p>	OR	<p>0.5 pt \rightarrow $\frac{1}{7} \times \frac{1}{6} \times \frac{1}{5} = \frac{1}{210}$ \leftarrow 0.5 pt</p> <p>0.5 pt \rightarrow $\frac{1}{6}$ \leftarrow 0.5 pt</p>
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Question 44(a)

(1 point)

<p>1 pt \rightarrow Fred has the correct answer.</p>

Question 44(b)

(2 points)

<p>Student's answers should address the following:</p> <p>1 pt \rightarrow John's solution is not correct because he calculated the probability of C and D, not C or D.</p> <p>1 pt \rightarrow - Amy's solution does not discard the probability of C and D occurring.</p>
